

**COOP'S
SATELLITE
DIGEST**



OCTOBER 15, 1986

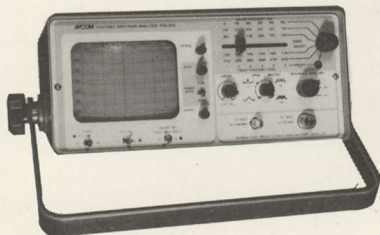
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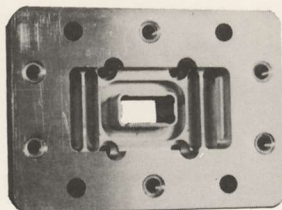
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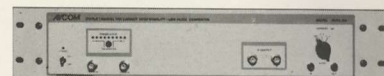


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TOP OF THE MONTH

VERTICAL interest networking, the craft of creating specialized program 'networks' for groups of people who share a common interest (such as coin collecting/ investment) receives our attention this month. We can create our own 'markets' by focusing our energies on specific groups of Americans. And sell plenty of hardware in the process.

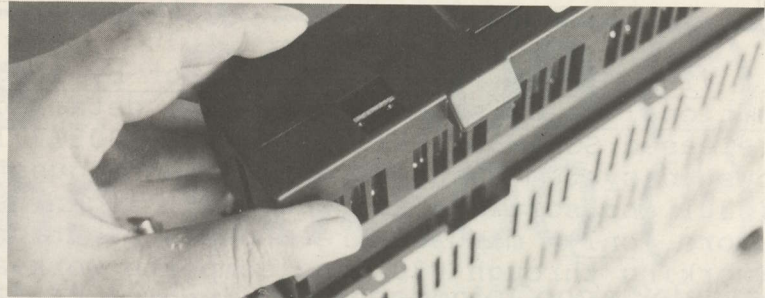
SURVEY. We conducted a dealer survey at the recent Nashville trade show to find out more about dealer attitudes regarding the selling of scrambled services. Our program guide publications want us to believe 'everyone is behind the sale of scrambled programming'. Our Nashville survey, involving more than 125 dealers, suggests this is not so.

AUSTRALIA. Not the TVRO market it once was; perhaps never to be a good market again. Scrambling is part of the problem as you will see. In our 'Be A Cable Operator' series we look further at the mechanics of the cable headend and spell out how you design the headend to provide cable related security.

GREEN SHEETS. Please remember that as a CSD subscriber you are entitled to a 'free' Green Sheets advertisement each year as a part of your subscription package. Turn now to our center section.

OCTOBER 15, 1986

PRESS-STOP/ Late Breaking News.....	2
COOP'S COMMENTS.....	4
VERTICAL INTEREST NETWORKS.....	6
SURVEY/ Where Dealers Stand With Videocipher.....	8



AUSTRALIA/ Part 3 of our South Pacific Report.....	13
GET RICH/ Be A Cable Operator (part 3).....	15
GREEN SHEETS/ Equipment Bargains.....	20A
ANTENNA AIMING REVISITED/ 'The Roberts'.....	21
SERVICE BENCH/ Alli Lake.....	25
CORRESPONDENCE.....	27
TRANSPONDER WATCH.....	30



OUR COVER/ TI-Buster Marina Albee apes a familiar 'Ghostbuster' posture in midtown Manhattan. Marina is VP of Kenny Schaffer's **Orbita Technologies Corporation** which specializes in providing Russian TV connections for US universities and colleges via satellite. Ghostbusters is appearing on Cinemax and Selec-TV this month, while Marina is busy preparing lobster for Kenny.

Photo credits to Beth Schiffer.

**COOP'S
SATELLITE
DIGEST**



COOP'S SATELLITE DIGEST published on the 15th of each month, dated for the current month, by CSD, Limited, a Turks & Caicos corporation with corporate offices located at Tower Plaza, Providenciales, Turks & Caicos Islands, British West Indies. Under contract, an office is maintained in Fort Lauderdale, FL (P.O. Box 100858, Fort Lauderdale, FL 33310; 305/771-0505) for the contracted purpose of processing all subscriptions, advertising orders, receipt of all mail and correspondence. All communications relative to CSD operations should be directed to this office. CSD, Limited also maintains an equipment testing laboratory for satellite receiving systems and components in the Turks & Caicos Islands. CSD routinely reports on the technical performance of equipment, both privately and in print. CSD also participates in the operation of 'test tube' low power radio and television broadcasting stations and a rural area cable TV system as an ongoing research project into the challenge of bringing modern communication services to third-world, undeveloped regions. **CSD subscription rates** are \$60 for 12 issues where U.S. zip codes apply, \$65 in US funds in Canada and Mexico and \$75 in US funds elsewhere. All non-US copies are sent via AIRmail. CSD has been published each month since October of 1979 and publisher Bob Cooper created the home TVRO industry in 1978. Single copies are \$6 in US and \$7 elsewhere. Bob Cooper, Jr. is publisher, CSD is copyrighted by CSD, Limited in the Turks and Caicos Islands and USA. **Second Class postage paid** at Ft. Lauderdale, FL. Application to mail at second class postage rates is pending at Ft. Lauderdale, FL. Direct dial telephone to CSD, Limited is 809/946-4273 but be warned; this is an expensive telephone call!

STOP-PRESS**Late News At Deadline**

VIDEOCIPHER is broken, but not by anyone you have heard about on national television according to detailed report appearing in newly released SCRAMBLE-FAX Newsletter (305/771-0505). Several groups have busted system using unrelated techniques involving software only (U30) and software/hardware (U7) techniques. Likely next step: Off shore (only) manufacture and distribution of cloned chip 'loaders' (working through U30) and complete work-alike descramblers original from chassis-up. Pricing? In region of \$300 to \$1,000 depending upon 'fix'.

SENATE DEFEAT (vote: 54-44) of amendment to force more equitable marketing of satellite programming to home dishes was disappointment to industry; new effort now planned for 1987. SPACE was not pleased with loss but delighted with nearness of vote which they say indicates strength of grass-root efforts involved in legislation. Cable TV industry expected home dish would garner no more than 20 votes; was surprised at strength of 44 votes.

PRIME-TIME 24 still plans November start date from Galaxy 3 of big market (New York, Chicago, Atlanta) network channels...but very unlikely to start November 1st as hoped. Service plans to run 'in clear' for two weeks, transmit 800 number (Videocipher) order information on sub-carrier. All 3 services will be on same polarization.

FIRST-RUN movie service (S1, TR9) has been experiencing problems with individual addressing portion of encoder/decoder system. They use Sony encryption technology and have been running in equivilent of 'fixed key' many nights allowing full access to all movies by any subscriber paying for one movie.

SPACE MERGER with DBSA moving ahead swiftly, smoothly. Mechanics of merger falling into place after DBSA board voted 7-0 in favor; SPACE financial debt down to \$162,000 (and falling) on October 6.

COMSAT, US representative to Intelsat and former producer of home dish systems (Amplica) trying to acquire nation's 3rd largest telephone company, CONTEL. Deal is worth \$2.6B and would change character of COMSAT significantly. Legal hurdles ahead.

SPACE SHUTTLE manifest just released; only defense and scientific payloads until 1991 or later with one significant exception; RCA has space in first (February 18) 1988 flight, apparently for Ku-3 bird. Shuttle hopes for 5 flights in 1988, 16 in 1989. In period 88-95, only 12% of flights will carry commercial (non-military, scientific) birds. This leaves most commercial bird launchers scrambling to find launch capacity such as Ariane, PRC's Long March, even Russia.

FED-X shutting down 'Zap-Mail' service immediately, may also cancel Expressstar satellite system totally. Citing extensive delays in getting satellites built and launched, Fed-X will take financial write-off of \$340M in shutting down Zapmail.

PRIVACY reform legislation, S2575, was adopted but includes soft fines for satellite violators caught using unauthorized services.

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COOP'S SATELLITE COMMENT

- DESUG'S Quandry
- TRIP - #2
- M/A-Com + GI = 's ???
- NETWORK Scrambling

-Editorial Comment from Bob Cooper-

DESUG/ Too Late To Qualify?

I have written a considerable amount of words concerning the effort of DESUG; the DES User Group. Several people have warned me against writing about DESUG; a fellow editor has even gone so far as to suggest that I am making myself liable for prosecution by the FBI by reporting on DESUG activities. That amuses me. Obviously we do not all share the same basic understanding of the First Amendment. I guess that is the stuff lawsuits are made of.

DESUG, for those coming into the game late, is a professional group of scientists and engineers involved in attempting to 'bust Videocipher'. Heading up the group is an old acquaintance named **Bob Richardson**. A former top exec at ITT, a former pilot for United, an author of more than a dozen computer programming and microwave technology text books, Richardson is a polished gentleman who could have stepped straight out of the Thomas Jefferson 'court' in the early 18th century. He does not look, act or talk like your typical 'traitor'.

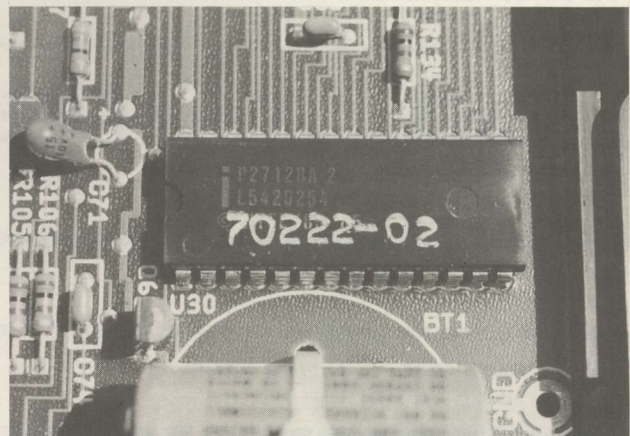
M/A-Com apparently wrote a letter recently advising firms that distribute and sell Videocipher that to ship or cause to be shipped a VC2000 outside of the United States **'might be considered an act of treason by the United States government'**. I rolled on the floor laughing about this warning; my intelligence sources tell me that as recently as mid August fully half of the VC2000 units being authorized **were being shipped outside of the USA** after authorization. I figure M/A-Com knows that a significant part of their production is going off-shore. And of course it is illegal to export VC2000 units since the exportation of DES technology is against the 'national interest' of the USA.

DES, or the Digital Encryption Standard/Data Encoding System, is about a decade old now. The US government, through the National Security Agency (NSA) 'adopted' DES as the 'official US government encryption system' for all **non-classified** documents. When the Department of State transmits a confidential memo to the embassy in Moscow, they encrypt the message with DES and fire it off through shortwave or satellite communication channels. When the US Army sends a message to a commander in the Philippines, they encrypt the message using DES before the message is plugged into the international circuits. The Russians know this, intercept the messages accordingly, and apply their best 'anti-DES' code breaking

techniques to the messages. I suspect they usually decipher the messages. NSA figures the same thing since they announced earlier this year that effective 1 January 1988 DES would no longer be the 'protected encryption system' of the US government. I'm not sure what this 'ending of official sanction' means to DES. I am not alone in not knowing; M/A-Com and others who have money and product invested in DES do not know either. I tried to learn if after January 1, 1988 it would no longer be 'illegal' to ship DES related equipment outside of the United States since after that date DES will no longer be the 'official encryption system of the US government'. Nobody seemed to know the answer to that one, either.

For now, M/A-Com suggests that tampering with the DES or exporting it **'could be considered an act of treason'**. That sounds like pretty serious stuff to me. That might also suggest how the US government officials could view those who would set out to 'bust DES'. Would they also be considered 'traitors' to their country?

DESUG is but one group working on the 'challenge of Videocipher'. As I write this, they may not even be the group that is nearest to total solution of the DES/Videocipher 'puzzle'. I am betting, however, that when the final chapter in the busting of Videocipher is written, DESUG will come out as the primary player in the puzzle bust-



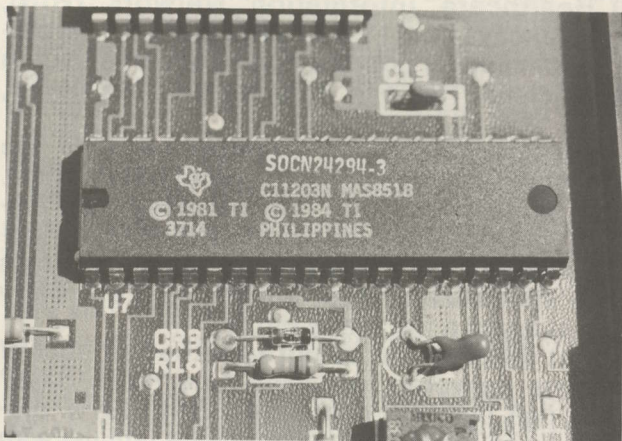
U30 CHIP is where most of the software routine efforts have been focused to date. DESUG and a handful of others do not believe this is a 'permanent fix'.

ing game.

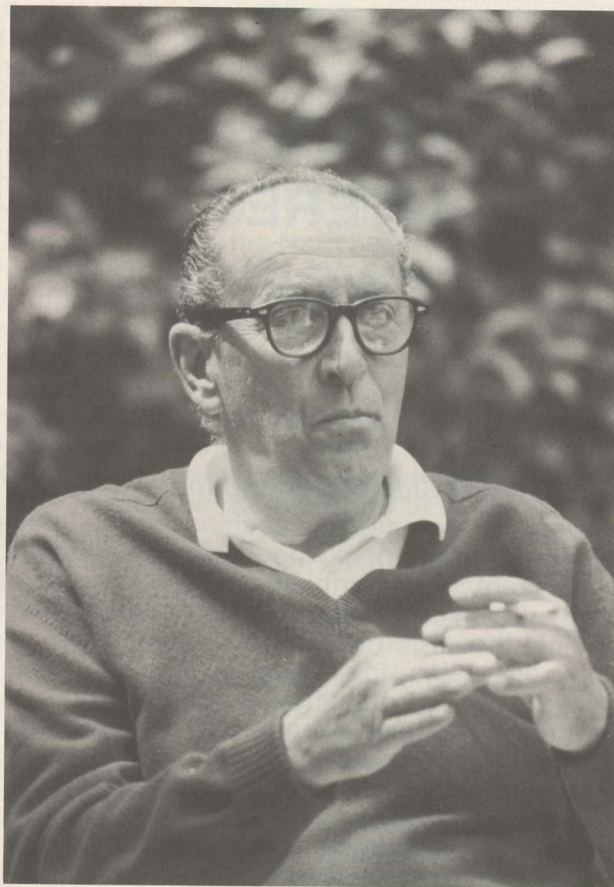
During the last six weeks, roughly since the Nashville show, my telephone has rung more and more often with people calling who claim to have 'busted Videocipher'. My notebook lists eleven different callers/groups at this point who claim success. DESUG is not on that list. I think we have to carefully scrutinize what 'success' in busting Videocipher really amounts to.

To render the Videocipher DES **harmless**, first you must understand how the DES system as employed in Videocipher functions. Few, this writer included, are ready to reveal that information, yet. There is good reason for this. Probably nobody but M/A-Com **really understands** all of the capabilities of Videocipher at this point. As more and more people and groups have tackled Videocipher, it has become apparent that it is possible to achieve a degree of success in 'patching around' the authorization code to gain limited access to either some or in some rare cases all of the Videocipher encrypted transponders on satellite. Virtually all of the people doing this sort of thing, and reporting success, have done so by concentrating on the software 'routines' accessible through device **U30** in Videocipher. It is possible, if you can modify the software instructions to U30, to bypass the authorization instructions and turn your Videocipher on (video and audio) on some, or all, of the Videocipher channels. DESUG people believe, however, that this 'software routine fix' is not the complete answer and that given a proliferation of the U30 solutions on the street, the software encryptors will make changes in the software routines to again render the U30 hackers useless.

To complicate matters, there are available **modified U30 chips** for a price which are in fact **not modified at all**; people have gone in and had Videocipher units authorized and then transferred the authorization codes to new U30 chips which they put on the street for sale. These chips do not receive anything but the services originally authorized for the 'mother box' and when the



GETTING RAM PROGRAM out of U7 was always considered a key point in busting Videocipher. Everyone thought it had to come out of U7 directly, which involved decapping or tapping into U7 while the device was still 'powered-up'. It was a surprise when the U7 RAM was accessed through U30 providing the 'keys' to the control of the system.



DESUG's Richardson is confident his group is 'doing the right thing' by staying after the challenge past the U30 solution.

owner of the 'mother box' neglects to pay for his ongoing services, all of the U30 'clone chips' will also cease working. So we have clever software people who have written 'patch around' instructions for U30, and we have banditos who are selling chips which they claim have been 'patched around' but which in truth are merely clones of authorized U30 chips. To date we have not seen any of the true 'patch around' U30 modified chips perform. Here's how you can tell the difference between a 'real U30 patch around' and a U30 clone.

Anyone who has been bright enough to figure out how to modify the software computer instructions is going to tell U30 to 'access' everything in the air that is Videocipher encoded. **That would include** transponders 1, 12 and 16, on Galaxy 1, as an example. None of these three transponders is available for home subscription. In other words, a person cloning an authorized U30 chip can only clone those services which are authorized **for home use**. He cannot offer you **Request TV** on TR12 or **Viewers Choice** on TR16 or the HBO promotional/test service on TR1. The seller of the clandestine chip **unable** to provide TRs 1, 12 and 16 may have a hundred excuses why he cannot produce these three transponders; all excuses are flimflam. The real answer is that the

COOP/ Continues on page 32

VERTICAL INTEREST NETWORKING

THE OTHER Side of Scrambling

Since the scrambling machine began rolling over us at break neck speed, we as an industry have spent the majority of our time trying to defend ourselves in the consumer marketplace against those detractors who would like to see home dish sales stop altogether. It is unfortunate that in being forced to the defensive position we as an industry have been unable to address the benefits which remain to TVRO and to develop a marketing strategy which points out those advantages. The purpose of this report is to suggest some new directions for the industry which should create considerable new sales potential for our dish sales. These suggestions diverge from the marketing efforts of the first five years of active TVRO in that they will require a certain amount of increased coordination between our own industry and those groups we target as potential, large scale users of TVRO in the future. Here is what this is all about.

CREATING Programming

The biggest thing happening in Ku band these days is the sudden explosion in 'corporate' or 'user networks'. As a section here in CSD summarizes, thousands of Ku band terminals are being sold and installed for groups as diverse as K-Mart and 7-11, insurance firms and telecommunication giants such as Hewlett Packard. In each of these corporate network situations, a bright set of management people has recognized the dollar value (or savings) which can occur when hundreds or thousands of offices or sales locations are inter-connected via satellite.

From the day the first home dish was installed until the present time, we have been selling home dishes by offering access to programming owned and distributed by others; third parties such as cable networks and the broadcasters. This worked to our benefit because we were relieved of the programming role and allowed to concentrate on what we do best; create, sell, and install low-cost

receiving terminals.

Now, with the confusion that exists in the mainstream marketplace because of scrambling, it is time to re-assess our role in the programming scheme. As numerous studies have shown, it is unlikely that we as an industry can afford the costs associated with massive uplinking of specialized programming intended primarily for home dish owners. While many would-be home dish user groups have formed, and are active in the marketplace soliciting financial support for such specialized services as 'The Movie Network' (TR13, S1), it is unlikely that more than a handful of such services can attract the dollar support needed to keep them on the air permanently. If, indeed, there does develop a package of low cost services for home dish owners, it is likely such services will be at least subsidized by a large corporate effort such as the NRECA group. So if your home dish industry is not financially capable of funding our own **massive** programming services, how and what role might we play in the programming part of the system to boost the sale of equipment packages?

The answer may not be that complicated.

SPECIALIZED Programming Services

Perhaps you have not really noticed but there has been a new type of specialized programming service coming up on satellite during the past six months. An example or two:

- 1) **Computer Distribution Network (CDN)**, weekdays from 2:45 to 4 PM eastern, Galaxy 2 (74 west), transponder 5. This service demonstrates recent developments in computer hardware and software and attempts to educate computer users and sellers to the features of the new equipment.
- 2) **Healthcare Information Network (HIN)**, weekdays from 1 PM to 3 PM eastern with programming for doctors, nurses and health care technicians. This one is found on Spacenet 1, TR9.

Neither of these two example services are scrambled. Neither plans to scramble at this time. Both illustrate the type of specialized programming which can be brought to satellite for a modest cost and obviously both programming sets have specialized target audiences. Let's carry that concept a few steps further.

What does it cost to put together an hour of satellite delivered television time these days? Let's use our own industry's BORESIGHT program as an example since most are familiar with the BORESIGHT approach and effectiveness to date.

- 1) One hour of satellite time can be leased for approximately \$300. The exact rate depends upon which satellite, which transponder and what hour of the day. It also depends upon how

many hours are bought and used since as the number of hours used goes up the cost per hour comes down.

- 2) Added to the cost of the satellite itself is the combined cost of tape playback of the program and the uplinking of that program to the satellite. Again, these rates vary but something in the range of \$200 per hour border on the normal top end of charges.

Thus between the two, we have in our BORE-SIGHT example \$500 per one hour show. Now, the one hour of programming: You can of course spend virtually any top end amount you have available. CBS's 'Sixty Minutes' reportedly budgets nearly \$1,000,000 for each week's show. But they have the advertising income to support such 'money-is-no-object' cost structuring. BORE-SIGHT, on the other hand, is on a very tight budget and the allocation per week for creation of the program is seldom more than \$3,000 per show. The secret here, if you can call it a secret, is to use a small, dedicated team of young professionals who view the program package as an opportunity to learn a trade and sharpen their own production skills. Just as CNN uses news interns at basically minimum wage to create the CNN programming we are familiar with, others can adopt the same technique to develop programming that is 'adequate' if not CBS quality for relatively few dollars per show.

One technique, put into service back in 1978 by Bob Cooper, was to utilize the local University or college journalism department as a production department. The original 'Coop's Satellite Magazine', on the air for two years starting in 1978 for one hour per week was put together at the University of Oklahoma School of Broadcast Journalism. Using junior, senior, and graduate students to operate the equipment, the average cost per one hour show was around \$500. The students received valuable real-world experience, gained the opportunity to sharpen their classroom skills, and had the satisfaction of producing a real program that was routinely viewed coast to coast by an audience in the tens of thousands. (That particular program was created for and directed at the nation's cable TV system operators and technicians.)

Now, what sort of programming would help us sell systems?

Make a list of all of the important, widely followed American hobbies and spare time activities. The list would include stamp or coin collecting, various card game pursuits such as bridge, sports and antique car restoration, hiking and camping, woodworking and shop skills, amateur music groups, home gardening, home health care, guns and shooting, writing for fun and profit, painting for fun and profit, home computing systems and soon.

The list would be hundreds of disciplines long. **Now, how do you turn such a list into money making, TVRO-growth incentive package?**

Let's select just one hobby and use it as an illustration. Guns and shooting pops out because it is hard to browse through a bookstand in a super market and not see at least a couple of 'trade magazines' devoted to the subject. There is also a strong user group, the National Rifle Association, in this field.

Suppose we as an industry, using the combined talents and backing of several original equipment manufacturers, numerous distributors and hundreds or thousands of dealers decide we wanted to get this particular market turned onto satellite programming. Where to begin?

Our object is straight forward; **we would like to sell a home dish to everyone of those enthusiasts.** To do that, we want to create a specialized programming service just for these enthusiasts. It could start in a small way, a program appearing perhaps just a few nights per week with a new one hour show each week.

First we would visit with the trade association in this area of interest (NRA) and as a delegation from the home dish industry explain what we are up to. We want to help the rifle and pistol owners become better educated and more expert with their hobby interest. **We want to create for them a regular satellite fed programming service just for their interest.** Would the NRA like to help???

Assuming we found the NRA interested, our next step is to form a programming committee made up of experts from this field. We'd put these people in touch with a production company that is skilled in low cost program production. The group from Boresight is an example of this, and already familiar with our own industry. The people at Satellite Showtime are another internal resource from our own industry.

Now, how do you fund this effort?

Let's assume we had three manufacturers who were willing to back this program; each would be doing so because they expected to sell terminals through the program. We'll pick on R.L. Drake, Uniden and STS because they are three of the larger survivors at the present time.

Now, our own industry has to put all of the elements together:

- 1) We coordinate the production of the programming, soliciting the moral if not outright financial backing of the trade association in this field (the NRA). **We take the responsibility** to see that the programming is there, on satellite, regularly.
- 2) We arrange for promotional efforts to all of the potential viewers (the members of NRA and others) to alert them to the programming, and then we direct these potential buyers of ter-

minals to **dealers** who handle the products of our original corporate sponsors (Uniden, RL Drake and STS in our example).

The 'package' could be put together so that the NRA comes out looking like it has innovated for its membership a new form of communication (the television program), so that the NRA members receive a 'discount' on their specially packaged 'NRA Dish Packages' and even so the NRA would receive a 'participating commission' when their members buy terminals. In return, we would expect the NRA to use their best efforts to help us defray the costs of the programming by helping us solicit and obtain advertising support from the corporate backers of NRA for the television programming.

Of course not all fields of interest have strong, national associations such as The National Rifle Association. But most of the fields of interest, to us, at least have trade or special interest **publications**. Where there is a magazine, there is a coagulation of 'experts' in the field of interest, and certain working relationships with hardware and software suppliers to that field of interest.

There are enough such groups out there, in America, to keep us busy as an industry creating and developing special interest 'networks' for the next several years. The advantages to this sort of vertical development of markets should be obvious to you.

- 1) Even if some of the subjects or groups chosen have limited air time already on special cable networks such as ESPN et al, we can have far greater 'impact' by selling the interested group **'their very own network'**. The amount of programming created for them will build as a direct result of the success of our initial 'seed efforts'. We should be bright enough to en-

courage and solicit independent programming from independent suppliers in each of these fields as a way to 'fatten up' the specialized network schedule.

- 2) The home dish industry can rightfully 'take credit' for implementing this program, and for the programming 'available exclusively on your dish'. We need this sort of **'only available on a dish'** programming in the same way that cable has capitalized on their programming exclusivity.
- 3) The invested dollars are within our range; we can handle the modest funding to get a service started. A modest 'advertising allowance' built into each of the initial systems sold for a new service would offset the initial program costs. Additional program revenues would come from either the involved trade association or the trade publications, or both.
- 4) To get it started, we have several 'in house' video production firms (Satellite Showtime, Boresight, and others) which could get the project operational. With programs generating revenues to offset production, additional production firms would be attracted into this aspect of the business.

The home dish industry needs the ability to have direct programming, and to be a part of the program creation process. Our dealers need to be able to point to a display and sign on the wall that reads **"Official Dealer: NRA Satellite Program Network"** and to be able to talk about the programming which **our industry** is helping to create, produce and distribute. We need these efforts to improve sales, and to build an image about our industry which we have missed to date.

SURVEY: WHERE DEALERS STAND WITH VIDEOCIPHER

If one was a consumer of TVRO, and only had access to one or more of the programming guides

sold to consumers, you **could** come to a conclusion that **the majority** of the home dish industry **supported the move to scrambled programming**. And in fact there is an undercurrent of approval for scrambling per se, if not for the present descrambler pricing and the present scrambled program distribution schemes and software pricing. As an industry, we have been 'on record' since the first national trade show in Oklahoma City (August 1979) as being 'in favor' of paying for programming. Participants at that first trade show repeatedly sought ways and mechanisms to allow for program payment and on various panels at that first show representatives for The Movie Channel, ESPN and WTBS's common carrier all held out the promise that some payment mechanism would come along. At least two (of the eight!) exhibitors at the 1979 trade show even offered (for sale) programming pack-

ages, not unlike the TCI program packages of today. Unfortunately, they would later learn that the programmers were withdrawing permission for the sale of programming to home dish owners even though some pioneers had shelled out as much as \$100 to The Movie Channel for a year's payment for the service.

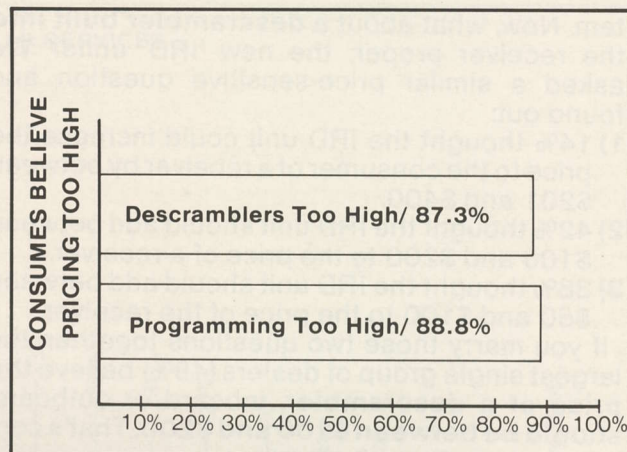
Paying for programming, by home dish owners, is as old as the industry itself. Almost as old as being on record as willing to pay for the programming is the reluctance of the various cable programmers to accept fees for their services. As an industry, then, **we tried** 'voluntary payment schemes' and this became one of the 'planks' of the SPACE platform when the trade association was formed in February of 1980.

At the most recent industry trade show, Nashville over the past Labor Day weekend, **CSD Magazine** and **Boresight News** (the television program) handed out lengthy survey sheets to dealers. We asked a total of 26 questions and provided multiple answers to each, to speed up the survey process. We offered neither rewards nor prizes for participating in the survey and more than 200 dealers took the 10-15 minutes required to answer the questions. We tally the results and offer our analysis of what we learned here. It is worth the 10 minutes it should take you to read the results to see where the 'mainstream of US and Canadian dealers' falls on the critical questions relating to scrambling of satellite services.

SCRAMBLER Pricing

Dealers constantly complain that descrambler prices are too high. Some OEMs such as Scientific-Atlanta have been packaging Videocipher units with complete home systems this fall, and that has lowered the effective price of a VC2000 to just under \$300 dealer net. Still other receiver suppliers are introducing 'IRD' or 'brick decoder' packages with the descrambler unit built into the home dish receiver electronics. Houston Tracker, Echosphere, M/A-Com, Channel Master and others are now entering the market with such units. At the outset, all such receivers are (very) high end priced and some are being marketed only as a part of a complete system (feed plus dish to receiver) and not as stand alone receiver-only units.

Most dealers feel \$395 retail list is too high for a VC2000 product. Dealers are also upset because their own 'margins of profit' in handling VC2000 is very small; typically under 10% for a \$395 item. The new IRD receivers effectively bury the actual portion of the price for the IRD descrambler built into the receiver by making the two virtually inseparable at this time. We do know that the OEMs building and selling receivers are paying



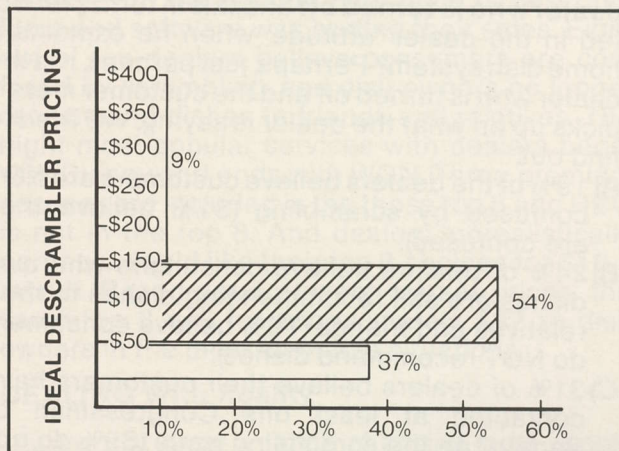
approximately \$150 for the M/A-Com (or Channel Master) produced IRD 'bricks' however so at least we have some basis for calculating the true cost of the receiver portion alone.

Dealers were asked to select a price range, for the VC2000 descrambler, which they feel would not create problems in the retailing of new home systems. This question was framed to reflect dealer feedback that when they had to explain that the descrambler portion of the system would **add \$395** to the cost of the system, many consumers balked at purchasing the descrambler at the time of new system purchase.

'So OK' we said, '**You (Mr. Dealer) tell us how much the descrambler could add to the cost of the system and not get in the way of the sale.**' Here is what we found:

- 1) 9% thought the descrambler could cost more than \$200.
- 2) 54% thought the descrambler could cost between \$100 and \$200.
- 3) 37% thought the descrambler had to cost under \$100.

That is for a stand-alone, separate descrambler sold with or after the sale of the home dish sys-



tem. Now, what about a **descrambler built into** the receiver proper; the new 'IRD' units? We asked a similar price-sensitive question and found out:

- 1) 14% thought the IRD unit could increase the price to the consumer of a receiver by between \$201 and \$400.
- 2) 42% thought the IRD unit should add between \$100 and \$200 to the price of a receiver.
- 3) 38% thought the IRD unit should add between \$50 and \$100 to the price of the receiver.

If you marry those two questions together, the largest single group of dealers (48%) believe **the price of a descrambler, inboard or outboard, should be between \$100 and \$200.** That's consumer cost, where it counts.

BEFORE

Before a consumer can address the pricing of software (programming), he has to understand and accept the price-cost of the descrambler unit. That will also apply with an IRD equipped receiver although many OEMs are betting that with the cost of the descrambler 'hidden' inside of the receiver, the cost of the descrambler portion will become a non-issue. We asked the dealers two key questions about pricing, one each for descrambler pricing and program pricing. The responses were virtually identical, telling us that dealers believe customers are turned off equally by high descrambler prices **and** high program pricing. We found:

- 1) 87.3% of dealers surveyed believed customers were turned off of home dish ownership because of the 'add-on pricing' of the descrambler.
- 2) 88.8% of dealers surveyed believed customers are being turned off by the perception that software program pricing is too high.

Are customers really turned off by **the pricing** of programming and descramblers, or **is it the dealer who is turned off** and this in turn is reflected in the dealer 'attitude' when he explains a home dish system? Perhaps, just perhaps, it is the dealer who is turned off and the customer merely picks up on what the dealer is saying. We tried to find out.

- A) 19% of the dealers believe customers are NOT confused by scrambling (81% believe they **are** confused).
- B) 24% of dealers believe consumers who own dishes are still recommending dishes to their relatives and friends (76% believe consumers do NOT recommend dishes).
- C) 31% of dealers believe their customers have contacted at least one Congressman or Senator on the scrambling issue (69% do not

believe their customers have done this).

This suggests that 4 out of 5 consumers remain confused, only 1 consumer dish owner in 4 believes in the product strongly enough to recommend it to others, and 1 out of 3 consumers has taken the scrambling issue seriously enough to contact an elected representative.

The positive side of this gloomy set of numbers is that probably 4 out of 5 **dealers** remain confused by scrambling, and if 1 consumer in three has written or telephoned a representative, the scrambling issue has generated at least 500,000 'contacts' between the electorate and the elected.

PROGRAMMING Choices

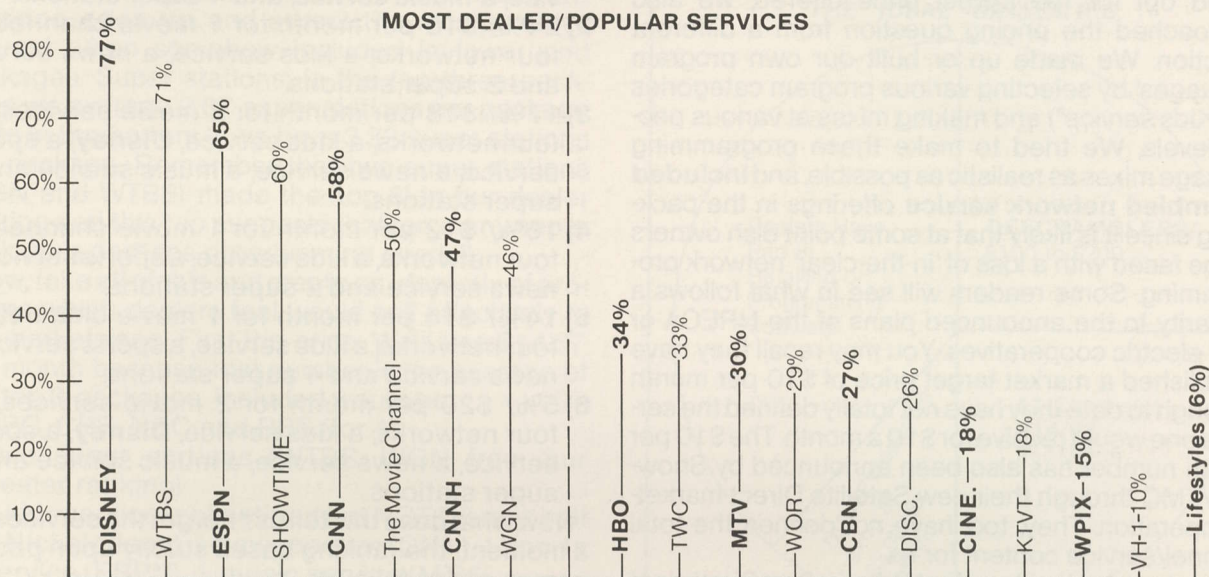
There is the continued PR problem of HBO; they are identified, at least within the TVRO industry, as "Peck's Bad Boy", the programmer that ran amuck unloading volley after volley of cheap buckshot into home dishes unable to defend themselves. We wondered how deep seated the dealer resentment of HBO ran.

"My customers would prefer to have name-brand movies services (such as HBO) rather than similar movie packages at lower rates".

67% of the dealers agreed with that statement, telling us that 'brand recognition' of premium movie services is, they believe, an important factor. That is an illuminating number because it says that 2 out of 3 dealers apparently feel more comfortable about 'selling' viewers on (for example) HBO than selling (for example) SelectTV. That also says that while lower prices are important, and certainly the goal of our industry at this time, brand recognition is a powerful force to be reckoned with in dealers minds. Clearly, what dealers want is **'HBO at lower prices'**, not 'equivalent non-brand movies at lower prices'.

Then we asked dealers to identify those services which they felt were the most appealing to home dish consumers. A dealer is him or herself a consumer of home dish programming so there is a measure of 'intelligent user brand awareness' here. The answer may surprise you. The percentages were calculated by taking all survey participants as a 100 percentile number and then showing the percent of 100 which favored certain programming services. There are 19 services in the survey and each person surveyed was asked to select **only 8** of those.

- 1) Disney/ 77%
- 2) WTBS/ 71%
- 3) ESPN/ 65%
- 4) Showtime/ 60%
- 5) CNN/ 58%
- 6) The Movie Channel/ 50%
- 7) CNN Headline/ 47%
- 8) WGN/ 46%



This is a breakpoint since if you were configuring a package that consisted of the **8 top rated services** (remember, we asked for 8 choices out of 19) this is the group that would make the first cut. Note that we have 3 out of 8 premium services, which based upon today's present pricing would cost a consumer approximately \$32 per month using lowest quoted home dish user pricing in the marketplace. Remember that \$32 number.

- 9) HBO/ 34%
- 10) The Weather Channel/ 33%
- 11) MTV/ 30%
- 12) WOR/ 29%
- 13) CBN/ 27%
- 14) Discovery/ 26%
- 15) Cinemax/ 18%
- 16) KTVT/ 18% (tie with)
- 17) WPIX/ 15%
- 18) VH-1/ 10%
- 19) Lifestyles/ 6%

Our question assumed that all 19 of the services shown here would (eventually) scramble and that consumers would be required to purchase the services either as part of a package or ala carte. This question, however, **ignored price as a consideration** and dealers selected their 'top 8' based upon program preference. Yes, we noticed that HBO did not make the 'top 8'; sorry Time Inc.

We asked dealers to select a dollar value for the top 8 services they had selected. To avoid penny by penny pricing selections we provided package pricing increments of \$2 starting at \$10 per

month and moving upwards to \$18 per month. This may not have been as good a question as it could have been since dealers naturally would like to see the lowest possible price regardless of the market price of established services. Therefore our lowest number (\$10 per month) 'won'.

- 1) \$10 per month/ 36%
- 2) \$12 per month/ 21%
- 3) \$14 per month/ 20%
- 4) \$16 per month/ 17%
- 5) \$18 per month/ 7%

Let's see where we are at this point. Dealers surveyed, by wide margins, believed that descramblers should be priced between \$100 and \$200 above the cost of a receiver, regardless of whether the descrambler was built into or was outside of the receiver proper. Nine dealers out of 10 believed the present high price of descramblers and software was hurting their sales. Eight out of ten dealers believe consumers are confused by scrambling, and dish owners no longer recommend dishes to friends and relatives. The eight most popular services with dealers begin with Disney and ends with WGN. Three premium services are included in the those top 8 and HBO is not in the top 8. And dealers, unrealistically perhaps, would like their top 8 choices for \$10 a month. Based upon present market prices, the same top 8 sell for approximately \$32 to dish owners in the most favorable situations.

DEALING With Reality

Aware that given a range of pricing most people

would opt for the lowest price offered, we also approached the pricing question from a different direction. We made up or built our own program 'packages' by selecting various program categories (ie. "Kids service") and making mixes at various pricing levels. We tried to make these programming package mixes as realistic as possible, and **included scrambled network service** offerings in the packaging since it is likely that at some point dish owners will be faced with a loss of 'in-the-clear' network programming. Some readers will see in what follows a similarity to the announced plans of the NRECA or rural electric cooperatives. You may recall they have established a market target price of \$10 per month although to date they have not totally defined the services one would receive for \$10 a month. The \$10 per month number has also been announced by Showtime/TMC through their new Satellite Direct marketing operation. They, too, have not defined the total channel/service content for us.

We asked dealers to select the smallest number of channels/lowest priced package which they felt would make dish sales restart again. In other words, what minimum service levels, available as a scrambled 'package' would attract customers back to the stores? We used the phrase '**Guaranteed Service**' to show that a dealer could **promise his customers** they would **always have access** to the package selected at the price shown. In other words, the assurance of the dealer and the programmers that the dish would in the worst case ALWAYS deliver the services listed for the price shown.

Here is how it shaped up. We rank them by dealer support, not dollar cost per month.

- 1) **25%**/ \$16 per month for 2 movie services, all four networks (ABC, CBS, NBC, PBS), a kids service (**not** Disney), a sports service, a news ser-

vice, a music service, and 4 super stations.

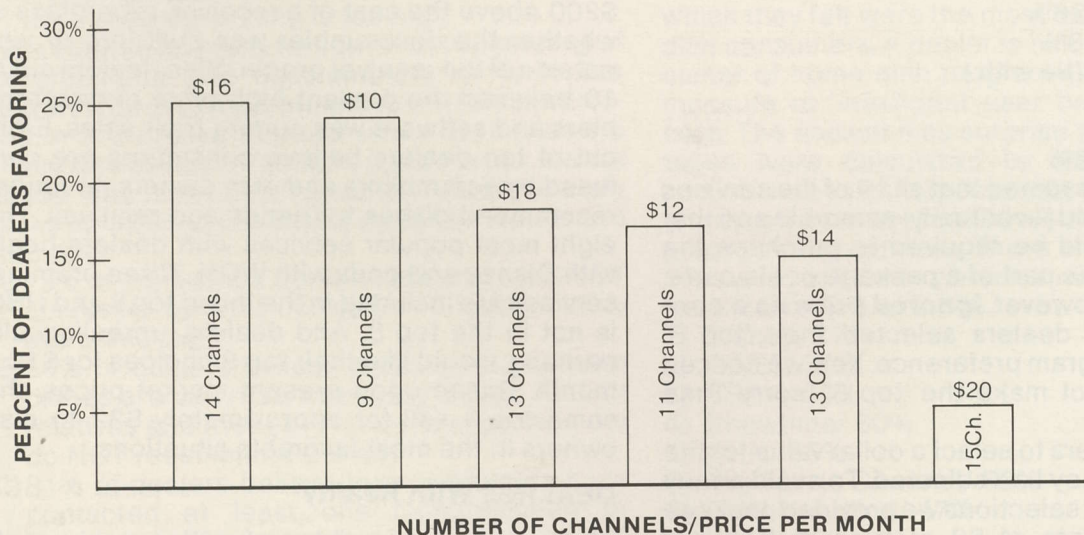
- 2) **24%**/ \$10 per month for 1 movie channel, all four networks, a kids service, a news service and 2 super stations.
- 3) **17%**/ \$18 per month for 2 movie services, all four networks, a kids service, **Disney**, a sports service, a news service, a music service and 2 super stations.
- 4) **16%**/ \$12 per month for 1 movie channel, all four networks, a kids service, a sports service, a news service and 2 super stations.
- 5) **14%**/ \$14 per month for 1 movie channel, all four networks, a kids service, a sports service, a news service and 4 super stations.
- 6) **5%**/ \$20 per month for 2 movie services, all four networks, a kids service, **Disney**, a sports service, a news service, a music service and 4 super stations.

Now what does this tell us? Forget the services for a moment; the ranking based strictly upon pricing comes out as follows:

- #1 - \$16 a month
- #2 - \$10 a month
- #3 - \$18 a month
- #4 - \$12 a month
- #5 - \$14 a month
- #6 - \$20 a month

The 'average' of the first 3 selections is **\$14.67** per month. The average of the bottom 3 is \$15.33 per month. Even within the relatively low end range of \$10 to \$20 there is still a price awareness although the program mixes for each changes substantially.

Disney, ranked highest with dealers overall, shows up twice in the study; once at the \$18 level and again at the \$20 level. In the **top 3** here we average 1.67 movie services per package while in the **bottom three** packages we average 1.34 movie



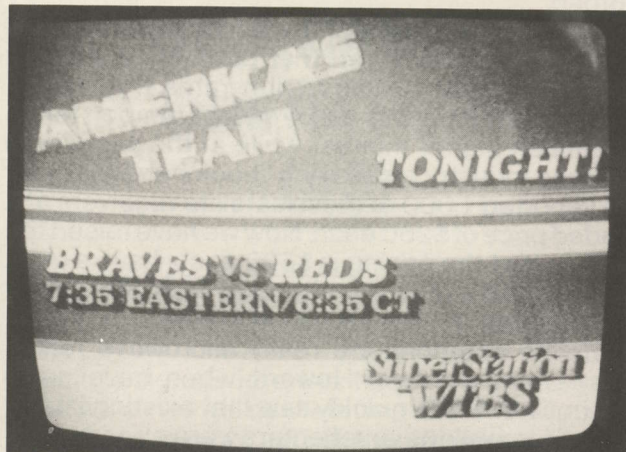
services. That suggest **movies are less important as price goes up** and attract the most positive interest when somehow included in lower end packages. Super stations; in the top three packages we average 2.67 super stations per package while in the bottom 3 we have 3.33 super stations per package. Remember that two super stations (WGN and WTBS) made the 'top 8' in our dealer ranking and this too suggests that too many super stations is perhaps programming overkill.

Now, take all of this and create an ideal mix of programs which dealers feel would sell effectively in the marketplace. First the price. We'll use \$14.67 per month because that number is the average of the top 3 packages. Included would be:

- 1) ABC, CBS, NBC and PBS (for 4)
- 2) Two super stations (WTBS, WGN from our dealer ranking)
- 3) 1 kids service (not defined but NOT Disney; call it Nickelodeon), 1 news service (CNN), 1 sports service (ESPN), 1 music service (MTV).
- 4) 1 movie service (Showtime would be chosen based upon popularity)

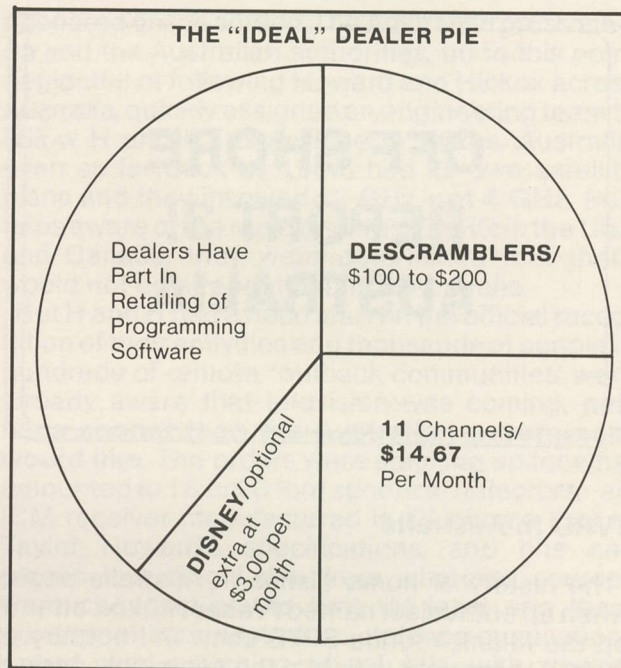
Again, **the price for this would be \$14.67 per month.** Now, how does that compare with the present announced package pricing?

Using the Primetime 24 rates for networks, they are asking \$1.39 per month per channel or \$5.56 per month total. Super station signals remain to be finally sorted out but \$1 per month seems reasonable at this time to expect. That's another \$2.00 per month. The miscellaneous group comes to around \$5 per month at present pricing with annual payments in advance. And Showtime comes in at \$9 a month under the most favorable discount packaging. Add the numbers up for these **11 channels** and you have **\$21.56 per month.** Comparing the 'dealer ideal' with the 'present reality' we have a 47% difference between \$21.56 and \$14.67. Dealers are saying



WTBS is the top-ranked broadcast service and top super station.

THE "IDEAL" DEALER PIE



they could live with and support the \$14.67 number but not the \$21.56 number.

All of this might be considered interesting but fanciful rhetoric were it not for the extreme animosity which continues to exist between TVRO dealers and programmers (only 1 dealer in 10 said he was 'comfortable' with the present situation). Clearly, while programmers say they are 'fine tuning' their software packaging and pricing, there remains a considerable variance between the present reality and the dealer-desired 'acceptable pricing' levels.

SUMMARY

So let's take all that we have learned from the CSD/Boresight Nashville dealer survey and put it into one spot:

- 1) **Descramblers should cost the consumers between \$100 and \$200**, and it makes little real difference whether the descrambler is in its own container or built into the receiver.
- 2) **Dealers believe consumers would not be turned off by a \$14.67 per month charge** for 11 channels of service, including all four networks, a movie service, a pair of super stations and a handful of other channels for balance.
- 3) **Disney is the most desirable service say dealers**, but dealers realize that Disney would have to be an additional cost above \$14.67 per month, or, if it was included, some other service(s) would have to be dropped from the basic package.
- 4) **More than one movie service**, more than 2 super stations in the 'basic package' is 'overkill' according to dealers.

OFF SHORE REPORT 3: AUSTRALIA

TVRO In Australia

The history of home dishes in Australia began when an enthusiast named **Fraser Hickox** attended the Miami, Florida SPTS show in February of 1980. He brought with him the seemingly perfect home system credentials. He represented a vast country larger than the United States with virtually no television reception at all over 80 percent of its landmass. The economy in those rural areas was good and there were signals of a sort available via Intelsat. Hickox and those who would follow him in later years were never certain how large their market might be but most numbered the market in the 100,000 region. It was to be a market with great appeal, sufficient to snare the interest of US pioneer **Taylor Howard** who would form a company in Australia to profit from the introduction of TVRO; it was a market destined to never materialize and with limited exceptions, nobody would profit from it at all.

Australia's great land mass is both a blessing and a curse. Most of the population of this continent-country lives along the coastal lines to the east, south and for a short distance, the west. Inland, as well as along the northern coastline, there are virtually no people and thus no terrestrial television service. Australian television began much like Canadian television; the first stations on the air (mid to late 50's) were operated by state radio services; **ABC**. Then as stated operated television (roughly akin to PBS in the USA) opened up the markets, limited commercial stations were authorized a channel at a time, a market at a time. Today in the very largest cities there are four to six channels with one or more of these devoted to ethnic programming for minorities. Outside of the major cities of Melbourne and Sydney, most regions have either two channels of service (ABC plus one commercial station) or just the ABC service.

Commercial television in Australia is very competitive at the business level and imported

programs from the US, Canada and the UK rank high with the commercial programmers. Satellite service is important for the commercial operators because it provides instant access to programming from all over the globe. CNN, CBS and NBC all have working relationships with Australian commercial stations/'networks' and all three services are sent full time for the entire broadcast day to Australia on Intelsat (*).

Australia now operates its own domestic satellite system, in Ku band. This is a fairly recent event, since this past February, and prior to the activation of **Aussat** there was limited ABC service distributed to rural regions on a leased Intelsat transponder with a spot beam directed into northern Australia. It was the presence of this 4 GHz ABC service, and the occasionally viewable other services from the same Intelsat satellite which fostered the original Fraser Hickox and Taylor Howard plan for satellite systems in Australia.

Australia has exceptionally restrictive import laws and duties for foreign made products. The intent of these laws is to 'protect' Australian industry from foreign competition. The original concept behind these high tariffs, perhaps now lost, was to encourage Australian firms to produce for home consumption and if possible for export as well. Take lawn chairs as an example. By placing a 50% duty on lawn chairs, Australia in effect said to **foreign importers** "Have a go at bringing in lawn chairs for sale here; but your product will cost **50% more here** than anyplace else". At the same time this high import on lawn chairs was saying to private firms **in Australia** "Have a go at making lawn chairs; there is a 50% region where you can produce and price your product which foreign imports cannot match." This fits the general Australian mandate to **create jobs for Australians** in manufacturing and distribution, keeping the Australian dollars at home rather than sending them abroad.

If a new field comes along, such as home satellite TV, and it is discovered that products are being imported at minimal import duty rates, the government generally moves to increase the import tariffs to a much higher number while at the same time going to industry and saying "Look here; last year we imported 1,000 of these satellite receivers at a landed price of \$250 each. Now we have raised the duty so that the pricing is \$500 each; have a go at building this product in the over \$250 but under \$500 range."

Satellite antennas are really microwave reflectors renamed. Taylor Howard, when traveling to Australia in 1980, quickly saw that existing import duties for microwave reflectors were already high. An Australian firm (**Andrew Antennas**) had virtually the entire market to itself, although at that time the market was quite small because it only

dealt with terrestrial microwave and all of that was licensed and tightly regulated by the Australian communications authorities. Howard and Hickox resolved that problem by reinventing the **Oliver Swan** 'Spherical Antenna'; a fixed mesh dish popular in US TVRO in the 1980-1981 time frame. These antennas could be fabricated on the spot where home systems were being installed, using local labor and often locally available (hardware store type) materials. Howard earned a nickname in the gregarious Australian press for his 'invention'; they referred to him as **'The Crazy Professor'** and wrote about him and his work as if he had just stepped out of a spaceship from Mars.

Artificially high prices on goods is an accepted way of life in Australia. Where there is competition (such as from bakeries serving the super markets with loaves of bread) the prices quickly drop to US-typical levels. In specialized fields such as satellite electronics, there is seldom sufficient market to support competition internally so one or perhaps two firms end up being sole-source suppliers to a continent, at prices they fashion to compete only with imported goods which have extraordinary tariff charges.

Hickox and Howard blazed a trail across Australia from Perth on the west to the remote outback. Their exploits today mirror image the exploits of the Bob Behars and Bob Coopers of the same era; pull into a new area, arrange to set up a spherical reflector, position the LNA and feed, find a satellite signal, and then be royally feted and gratefully acknowledged by the 'locals' when magic television

appeared on the screen. The Australian press ate it up and the Australian authorities, up to this point neglectful of following Howard and Hickox across Australia, quickly assigned an engineering team to follow H and H from village to village. Australia, even as far back as 1980, had its own satellite plans and they involved 12 GHz, **not 4 GHz**. Perhaps aware of the rapid growth of TVRO in the USA and Canada, they were determined that there would not be a repeat of this in Australia.

But H and H had a head start on the official recognition of their activities and thousands of people in hundreds of remote, 'outback communities' were already aware that television was coming; **perhaps sooner than the Australian government would like**. The orders were stacking up for what amounted to 16 or 20 foot spherical reflectors, an ICM receiver manufactured in Oklahoma City to Taylor Howard's specifications, and bits and pieces including LNAs from whatever sources were cheapest at the time. At least one then-government-connected telecommunications expert was watching all of this with special interest; her name was **Olga Sawtelle** and she would later become the largest distributor of TVRO systems in Australia and the South Pacific, after leaving government agency employee to strike out as an entrepreneur.

*/ US network programming is transmitted via Intelsat across the Pacific to users in Australia and elsewhere using a **split transponder/interlaced technique** developed by RCA in 1980.

AUSTRALIA/ continues in November

GET RICH/QUICK: BE A CABLE OPERATOR (#3)

GETTING 'OUT' Of The Headend

Getting signals into the headend, a subject to itself which we will deal with in a later installment of this series, is only part of the challenge. Getting signals 'out' is the other half of the job.

Because each channel carried on the cable system is individually processed by electronic

amplification (ie. off air signals carried on the same channel as they are received) or by an RF signal 'modulator', we find ourselves faced with marrying each of these various channels together so they travel together in the same cable to the subscriber homes. This is not complicated but there IS more to it than merely tying a bunch of cables to the same point.

Cable works the way it works for the same reason that AM or FM broadcast radio works. Stations or channels can all occupy the same cable because they are operating on different, distinct, frequencies. The 'radio spectrum', or the frequency **band** in use, is very 'wide' and an individual channel only utilizes a small portion of this spectrum. We assign each programming source to its own frequency and by properly spacing the channels we can operate one channel right after another through the same cable (or through the air as in broadcasting) without creating interference between the channels. **A table appears here** which defines the typical channeling in use for cable services in North America. This frequency assignment table varies as a function of the television 'standards'

system in use; the table here is for NTSC service.

Any channel carried on the cable must be 'clean'; that is, it must produce signal(s) within its intended frequency band but not outside of that band. Channel 3, for example, is assigned to the 6 megahertz (MHz) region from 60 to 66 MHz. Everything coming into the cable system from the headend for channel 3 must be confined to that region; 60-66 MHz. If you are using a modulator to generate or create the channel 3 signal, it is important that the modulator produces only signals within the 60-66 MHz region. If by some design or adjustment flaw it also produces signals outside of the 60-66 MHz region, those unwanted signals will probably interfere with some other cable transmitted channel. For example, if the modulator has an unwanted output signal within the 120-132 MHz region (**twice** 60-66), your cable service on channels A (120-126 MHz) and/or channel B (126-132 MHz) will suffer. It is a fairly common design problem with modulators and other 'transmitters' that they create signals at a lower (but detectable) level at some multiple of their primary output frequency; such as twice the operating frequency, three times the operating frequency and so on.

One of the design flaws in a low cost modulator is that no special effort is taken to eliminate these 'out-of-band' interfering signals. If a modulator is used all by itself, such as to produce a modulated RF output for a single satellite receiver, these out of band signals are seldom a problem since the user is only watching the modulator output by itself on a single channel at a time. When you try to 'add' such a modulated signal to an existing cable distribution system (such as within a household), these interfering signals take on new importance since they may well cause problems with other channels being distributed by the in-house system.

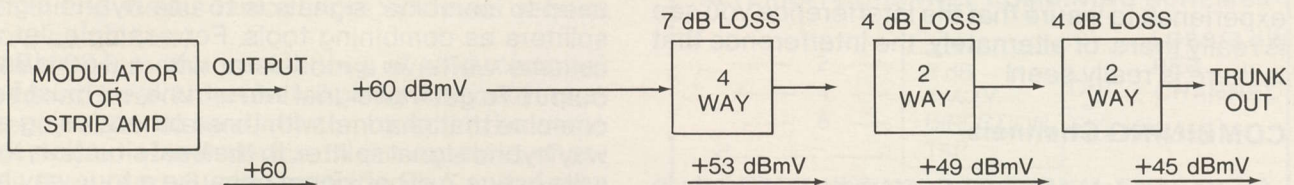
A common problem with low cost modulators is something called 'the lower sideband'. The TV signal for our example channel 3 is supposed to be confined to the spectrum from 60 to 66 MHz. However, a low cost modulator may not do this job very well and in addition to having potential interference at 2 times or 3 times the normal operating channel frequency, we may also have a greater spectrum 'width' at channel 3 than we desire. This happens because the TV signals are 'AM' or amplitude modulated (video) and in the amplitude modulation process **two separate** video signals are produced. The TV set needs and wants to 'see' just **one** of those signals and in a higher grade modulator the 'unwanted sideband/signal' is filtered out so it is not 'transmitted'. In a lower cost modulator, there is a '**double sideband AM**' signal transmitted and rather than occupying the region from 60-66 MHz, it may well extend from 57 to 66 MHz. Those extra 3 megahertz, 57-60, fall into the next lower adjacent channel (channel 2) and the

NORMALIZED NTSC CABLE ASSIGNMENTS

Channel	Frequency
2	54-60 MHz
3	60-66 MHz
4	66-72 MHz
Buffer	72-76 MHz
5	76-82 MHz
6	82-88 MHz
FM Band	88-108 MHz
A	120-126 MHz
B	126-132 MHz
C	132-138 MHz
D	138-144 MHz
E	144-150 MHz
F	150-156 MHz
G	156-162 MHz
H	162-168 MHz
I	168-174 MHz
7	174-180 MHz
8	180-186 MHz
9	186-192 MHz
10	192-198 MHz
11	198-204 MHz
12	204-210 MHz
13	210-216 MHz
J	216-222 MHz
K	222-228 MHz
L	228-234 MHz
M	234-240 MHz
N	240-246 MHz
O	246-252 MHz
P	252-258 MHz
Q	258-264 MHz
R	264-270 MHz
S	270-276 MHz
T	276-282 MHz
U	282-288 MHz
V	288-294 MHz
W	294-300 MHz

'lower sideband picture information' will interfere with the proper reception of channel 2 on the cable. If you used a full headend of lower grade modulators, virtually every channel in the system would end up with interference caused by the lower sideband from one channel falling into the next lower channel on the system.

Most modulators sold for cable purposes have the 'lower sideband filter' built into the modulator. But not all, and for this reason firms such as GI/Jerrold, Blonder-Tongue and others sell single channel 'bandpass filters' which are installed immediately after the modulator to 'clean up' (filter out) the lower sideband signal. Ten years ago it was pretty standard practice for the cable firms to routinely install bandpass filters (BPFs) for every channel they carried out of the headend on the cable. That was before the current/modern family of modulators which do an excellent job of reducing or even eliminating unwanted output signals from modulators. All of this is very important to the headend designer since when you bring two or 20



MODULATOR OUTPUT — AS HEAD END MODULATORS ARE 'COMBINED' (MIXED), THERE IS 'LOSS' DUE TO COMBINING, MATCHING CIRCUITS. TRUNK INPUT LEVELS ARE ESTABLISHED **NOT** BY MODULATOR OUTPUTS ALONE BUT BY COMBINING 'LOSSES' (15 dB IN OUR EXAMPLE).

or more channels together to feed into the trunk cable, you are mixing not only the **wanted** cable modulator output but also the **unwanted** output from the modulators.

There are several ways to determine if a modulator has a 'clean' or a 'dirty' output. In this case 'dirty' means there is interference-capable output signals coming out of the modulator. The most elegant method is to connect the output of the modulator into a spectrum analyzer. The analyzer is used to tune through the full frequency spectrum of the cable to see if there are any signals present on any frequency other than the desired output channel. Even the best modulators will have some (weak) output on one or two frequencies **other than** the desired channel but typically these outputs will be -50 dB or more from the output on the desired channel. Such weak unwanted output on the generally not cause any serious problems with the cable operation. Levels less than -50 dB (reference the main carrier output), if they fall into 'active portions' of cable channels in use on the system, will however cause picture degradation; squiggly lines in a herringbone fashion across the screen (for example).

Lacking a spectrum analyzer, the next best trick is to use a quality cable field strength meter connected to the output of the modulator. This must be done with some caution, however, since it is possible with a modulator that is in the +50 to +60 dBmV signal voltage region to 'overdrive' the field strength/signal level meter causing 'false readings' on the meter proper. Suffice to say you can both 'miss' and falsely detect interference signals that are coming out of a modulator with a cable signal level meter and you need to be careful about conclusions drawn with this measurement technique.

Another technique is to feed the output of the modulator into a color TV set. Again, this warning. When you hook a +40 to +60 dBmV output modulator directly into a TV set, you are going to 'overdrive' the TV set with signal. The extra strong

signal to the TV set will cause the receiver to produce 'non-linear' reactions. That's a fancy phrase for 'the TV set creates new signals where no real signals exist'. The way around this is to place in line padding between the modulator and the input to the TV set so that the TV set receives a normal signal in the 0 dBmV to +10 dBmV range. Now you can tune from channel to channel, through the full cable spectrum, to see if you can spot any sign of unwanted signals. If the modulator is the only signal source the TV set has, and the TV set is receiving a normal (0 to +10 dBmV) signal on the modulator channel, as you switch from channel to channel you should see nothing but pure dancing black and white snow dots on all **other** channels. You may see a slight graying of the raster on the channel just below (ie. one lower) and the channel just above (ie. one higher) and as long as the graying is slight that probably means the modulator is clean and the change in pattern is a measurement of the lack of TV set 'selectivity'. On all other channels the screen should be the same with the modulator connected or disconnected from the TV set. If you run into a channel where you think there is some sort of signal appearing, turn off or disconnect the modulator to see if the pattern changes or goes away. If it does, you have an unwanted signal from the modulator.

The danger with this technique is that by padding down the output of the modulator to the TV set, so as to not overdrive the TV set, you have **also padded down** the unwanted interference signals coming out of the modulator as well. In other words, interference that was 40 dB lower in level than the full output of the modulator is now 40 dB **plus** the amount of the pad/attenuator weaker. This might be so much weaker that you cannot see it on the TV set. Another method is to alternately switch the pad between the modulator and the TV set 'in' and 'out' of the line to see if the snow image on channels other than the modulator channel changes with different signal levels to the TV set.

Always, using a TV set as a modulator-interfer-

ence chaser demands careful analysis and some experience to insure that the interference you see is really there, or alternately, the interference that is there is really seen!

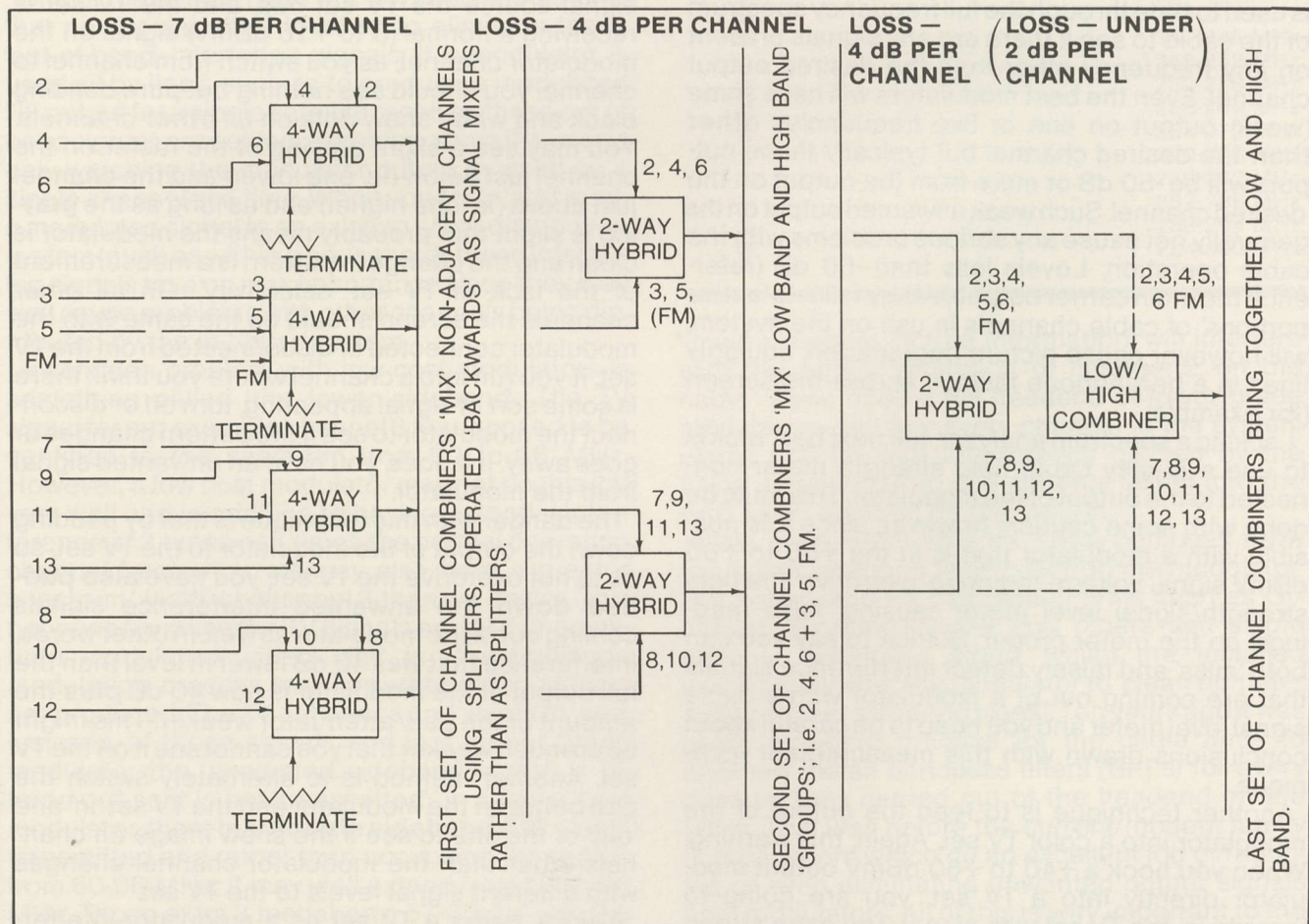
COMBINING Channels

Most cable intended modulators have outputs in the +40 to +60 dBmV region. Remember the fundamental law of cable is that the cable system is a 'giant loss machine' and your job is to overcome or counteract that (cable) loss with appropriately selected and spaced line amplifiers. All of this begins at the headend where the first significant 'signal voltages' are generated.

Ideally, we would like the full modulator (or strip amplifier) output to be available to feed into the trunk system. This is not an ideal world and there is no appropriate technique that allows us to arrive at the input to the trunk cable, after combining two or more channels, with all of that output level signal intact. In other words, in the process of combining signals we lose signal. It is just like 'splitting' signals in a TVRO dish installation to connect or feed two or more receivers to the same dish.

As a matter of fact, one of the common techniques used to 'combine' signals is to use hybrid signal splitters as combining tools. For example, let us assume we have a modulator with a +60 dBmV output. To get that signal into a trunk, we must first combine that channel with three others, using a 4 way hybrid signal splitter. In the best situation, that will cost us 7 dB of signal because a four-way hybrid splitter, whether used 'frontwards' as a splitter or used 'backwards' as a combiner, loses 7 dB. Then we have to combine those four channels with another group of channels and that requires a two-way splitter. And this is an **additional 4 dB** of loss. Finally, we have one more 'combiner' to go through and that is another two-way unit so we have 4 dB more loss. Finally we are at the trunk input, but in the process we have lost 7 + 4 + 4 dB or 15 dB from the original +60 dBmV output. All of that just to mix channels together and get out of the headend! **We diagram that here for you as an example.**

To be sure, there are several methods available for combining headend signals together and some of these have slightly lower losses than others. But in the best situation, there is sizeable combining loss and the greater the number of channels in use



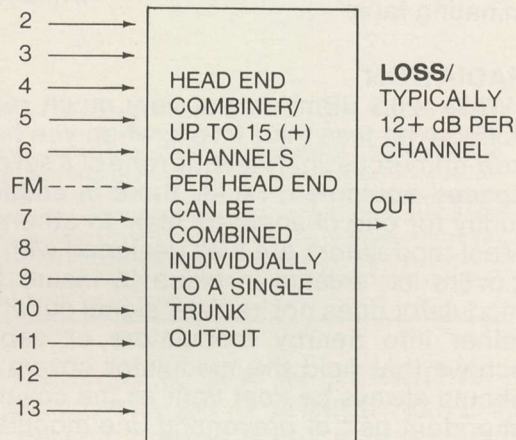
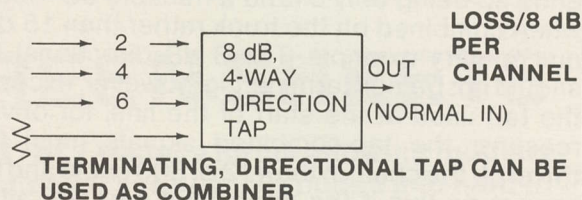
on the cable, generally speaking the greater the combining losses (since more channels require more combiners).

We diagram the combining of a 12 channel headend here. Note the following. Adjacent in frequency channels are not combined in the same (passive) combiner device. In our example, channels 2, 4 and 6 are combined in one 4-way combiner and the unused (fourth) input is terminated because it is not used. Channels 3, 5 and the FM band are combined in another combiner, and we again terminate the unused input. If there was no FM band, a two-way combiner could be used here. At this point we have the low-band channels (2-6 plus FM) on their way. Below, channels 7, 9, 11 and 13 are combined in a 4-way unit while channels 8, 10 and 12 are combined in another 4-way unit with a termination on the unused port.

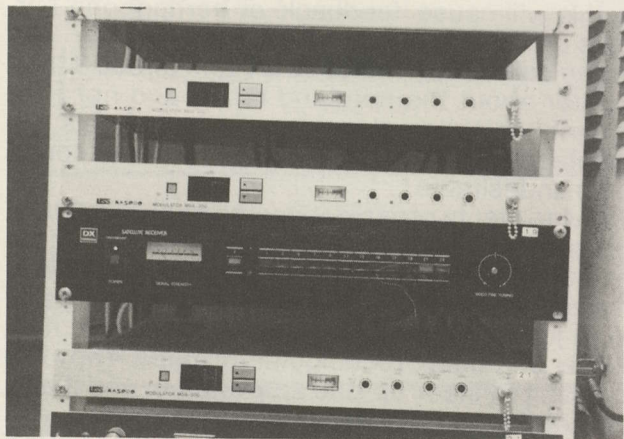
Next we recombine all of the low band channels together by adding 2/4/6 and 3/5/FM together with a two-way hybrid combiner/splitter. And the high band signals in the same manner. Now we have two spigots left; one with high band and one with low band/FM. All 12 channels now come together with a final two-way hybrid combiner OR we can use a special variation of the same concept called a low/high combiner (it has separate input ports for low band and high band). At the end of the chain, we have 12 channels all on the same cable.

This output, from the last two-way or low/high combining unit, is the input to the trunk. As we saw in our earlier diagrammed example, we have the combined loss of a 4-way (7 dB) and a pair of two-ways (4 dB each) or 15 dB loss total through the system. That means that if every modulator in the

ALTERNATE CHANNEL COMBINING SCHEMES



SPECIAL CHANNEL-ALTERED HEAD END COMBINERS CAN BE USED TO SIMPLIFY HEAD END DESIGN AND MINIMIZE LOSS OF HEAD END LEVELS.



BE CAREFUL stacking up modulators and receivers; heat generated by units must have someplace to go other than 'up' into next unit in the rack. Heat buildup shortens equipment life and increases the frequency of power-supply-section failures at the headend.

system or every channel source started out at +60 dBmV, the actual trunk input will be +60 **minus 15 dB** or +45 dBmV. This effects how our cable plant plans out on paper, and where we will place the first trunk line amplifier in the system since there is a considerable distance-difference between starting out at +60 and +45 (dBmV). The actual signal levels to the trunk input cable will not be +45 dBmV in any event, at least not 'flat' (ie. equal) on all channels. We'll see why in a subsequent installment.

Special pieces are sold for headend combining which replace the separate 2, 4 (and even 8) way splitters used 'backwards' as combiners. Some products allow you to 'field tune' small passive bandpass filters so you can optimize various channels on low OR high band into the system. Other products build combining networks into a single container allowing some number such as 15 channels to be combined in a single box. The net result is basically the same as using hybrid splitters as combiners except you can do it with fewer jumper cables and sometimes less grief. Another technique is to use 8 dB value **directional taps** as 'backward combiners'; run a piece of 412 or 500 cable around the headend racks and attach one channel to each input (output) spigot on a directional tap. This is one of the cleaner ways of doing it since the solid aluminum jacketed cable is unlikely to allow

interference through its shield, and each channel ends up being only 8 (and a fraction) dB 'weaker' when combined on the trunk rather than 15 dB in our primary example. The 8 dB directional taps should not be 'self terminating' however, except for the tap used at the start of the line, for obvious reasons; the tap-combined signals must **flow through** the chain in the 412 or 500 cable and they cannot do this if the directional taps are all terminating taps.

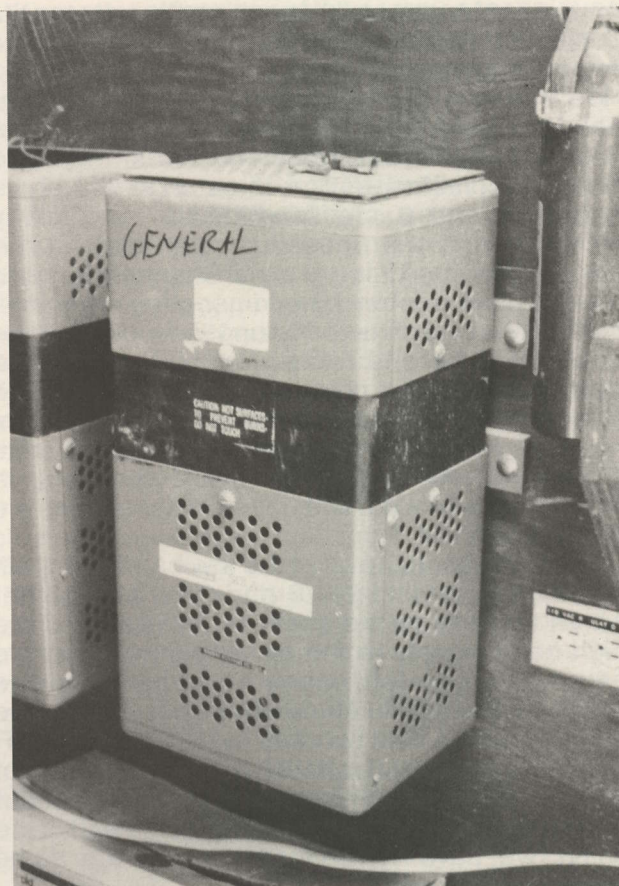
RADIATION

While +60 dBmV is not very much real signal voltage (far less than 1 volt), when you have 'packed' numerous channels into one or a set of closely spaced equipment racks, there is ample opportunity for one channel to 'leak' to others nearby. Most modulators are well designed with RF tight 'covers' or 'shields' in place to insure that one modulator does not 'radiate' signal out of the container into nearby modulators or cables. The screws that hold the modulator covers in place should always be kept tight as the covers are an important part of preventing one modulator from 'talking to' other modulators in the headend system.

Anything that should (ie. is designed to be) terminated should be terminated. That means a 75 ohm termination in place. Test points provided for signal measurement purposes do not need to be terminated but test points should also not be left with 'test jumpers hanging loose' since an unused test jumper becomes a small 'antenna' that radiates signal when not in use.

Headend cable practice is very important. At levels such as +60 dBmV (straight out of the modulator) you can expect the signals within the jumper cables (connecting modulators to combiners and the trunk input) to try to 'radiate' into the air. Commonly available RG-59/U cable is a very poor choice for wiring up a headend because typically it has poor shielding qualities. There are special extremely high shielding cables available just for this sort of application and what you are looking for is either high copper braid percentage (such as 97%) PLUS an aluminum foil wrap, double shielded copper braid with a combined shield effectiveness in the 99% region, or a double foil shielded cable. Most designers use RG-6/U rather than 59/U because it is physically stiffer and less apt to be damaged with normal bumping and wear and tear at the rear of the headend rack.

Rout (direct) combining cables so that high level inputs (such as those that come directly out of the modulators at the highest signal levels) are not in close physical proximity to lower level cables (such as those that go INTO on-channel strip amplifiers). You don't want a high level signal, leaking through



SOLA Constant Voltage Transformers protect headend gear against power brownouts or glitches. A word of caution; buy one Sola large enough to power every video receiver and modulator ever likely to be in the headend to avoid '60 cycle loops' that can cause objectionable AC hum on the processed channels.

an imperfect cable, to sneak into a low level input as this will cause 'feedback' or herringbone patterns on the affected channel.

Keep combining cables short, and direct. If they wander about the headend racks, and not high integrity shielding, the relatively high levels will radiate from the 'jumper-antenna' lines into something undesirable.

Provide plenty of ventilation; the habit is to stack up equipment in a rack without adequate concern for how the air will flow around the units. Most modern modulators and satellite receivers are thin (from just under 2 inches to 4 inches tall in rack space) and deep; rectangular in shape. They are tempting to 'stack up' one atop another and that is **not good practice** since the heat from lower units circulates upwards (heat rises) making those at the top very warm. Extra heat causes premature failures so it is best to group equipment by channels and then leave a blank rack panel in between chan-

GET RICH/ continues on page 21

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- 6) If you are a **DISPLAY** advertiser in CSD currently, your cost is \$20 per listing. Enclose payment with listing(s).
- 7) If you are **not** a CSD subscriber, **shame on you**. For this oversight on your part, enclose **\$35 per listing** and may your Vidare dish take on a permanent warp in the shape of a Ruffles potato chip.
- 8) Mail this form, **your payment**, and anything else you think Coop might like to **CSD Green Sheets, P.O. Box 100858, Ft. Lauderdale, Fl. 33310**. OR. Or, drive Carol bananas by **telephoning 305/771-0505** between 9 AM and 4 PM weekdays eastern time and have your VISA or Mastercharge card handy along with your carefully worded listing.
- 9) Listings that run beyond 120 letters/numbers/spaces will be edited to size by Alli Lake (aka 'Alli The Ax') and neither Alli nor CSD are responsible, legally, financially, nor morally for how your listing is butchered in the process (avoid butchered listings; count to 120 carefully).

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YOU ARE ENTITLED TO ONE FREE
CSD-GREEN-SHEETS LISTING
PER-YEAR AS A CSD SUBSCRIBER.

GET RICH/ continued from page 20

nels; ie. receiver and modulator for channel 2, a blank rack panel for ventilation, a receiver and modulator for channel 3 and another blank panel and so on.

Many headend units have microprocessor memories and some do not have battery backup built-in. This means that when power goes off or glitches, the units (such as receivers or modulators) may reset to a neutral state; either on no channel at all, or on the lowest channel in the system, when the power comes back on. You haven't seen interference until you have 24 modulators all putting out signal on channel 2 at the same time! There is a double design problem here; first, to protect headend units from power brownouts or line glitches, power the entire headend off of constant voltage transformers such as those manufactured by **Sola**. Next, if your headend is located some distance from a handy tech who can reset modulator

or receivers to their proper tuned state after a power outage, consider a non-interruptible power supply such as those designed for computer system use. At the very least, ask your modulator supplier what happens if the power goes off; do the units come back on as they were tuned, on the right channel and with the right audio sub-carrier, or do they come back on in a neutral (need to be reset) state? The same question should apply to satellite receivers as well since a receiver that 'forgets' the audio sub-carrier it was tuned to when the power goes off will be a constant source of readjustment problems for you if you must make special trips to the headend to correct the audio setting.

The headend is the key to cable system performance. Complex headends can easily cost thousands of investment dollars per channel initially so the system designer needs to carefully consider all of the practical problems related to the equipment before making decisions.

This series will continue next month.

ANTENNA AIMING REVISITED

There are currently about thirty satellites visible to the US. As their numbers have increased there has been the desire to align the mount of a single focal receiving dish in ways which allow it to change the dish from satellite to satellite with

By Daniel W. Roberts

Gourmet...Entertaining
3915 Carnavon Way
Los Angeles, Cal 90027

Roberts, son of James M. Roberts, of Gourmet... Entertaining, shares his father's interest in accurate pointing of satellite dishes utilizing a "polar" mount. His research and subsequent development of a computer program which calculates pointing errors leads us to a new level of aiming accuracy when using a polar mount. In "The LND" (page 23), Roberts' data is put to use in providing us with some little-known numerical data resulting in almost-perfect tracking of the Clarke orbital belt.

accuracy and simplicity. It is this question of alignment which I have succeeded in answering with a new computer program. The following documentation is provided so as to allow an understanding of what the problem is and how I solved it.

The television satellites orbit the earth in a geostationary orbit. This is to say that at their orbital radius, they are traveling at such a speed that their rotation equals that of the earth. Their orbit is in the plane of the earth's equator. Thus they never appear to move from their positions in the sky.

In the late 1970's it was suggested that because astronomers had been able to align their telescopes to view stationary objects while the earth moved, perhaps the same process could be worked backwards to mount a dish to sweep across the geostationary satellites. The astronomers had devised a system of aligning the axis of their telescope's mount parallel to the earth's axis. Then they would simply adjust the telescope, without changing the axis, until they viewed what they wanted. By simply rotating the telescope on its axis as the earth rotated they could continue to observe the celestial body or phenomena for prolonged periods. When "polar tracking" was tried with the satellites a problem was encountered.

The stars the astronomers had looked at were so far away that they were "at infinity". The satellites, however, are not at infinity, they are only 22, 241 miles out from the earth. If the site of the receiving dish is not on the equator then setting the dish's rotational axis parallel to the earth's rotational axis would cause the dish to look over some satellites, and/or under others. If the dish is not on

the equator and yet its axis of rotations (of its look cone) is perpendicular to the equatorial plane, the intersection of the look cone and the equatorial plane is a circle. Unless the dish site is on either of the earth's poles, that circle is not concentric with the satellite circle. Instead of being perpendicular to the equatorial plane, the dish cone axis should be tilted at some angle. By having the look cone intersect the equatorial plane at the correct angle, an ellipse would be formed that would reasonably match the visible segment of the circle of satellites.

The better the elliptical segment matched the segment of the circle containing the satellites, the better the reception. It is important to note that geometrically an ellipse is never exactly congruent with a circle so there is no way to calculate the perfect ellipse - there is none. The problem was to find the best possible fit.

I developed a computer program which utilizes basic, but exact, trigonometric functions. Each of the satellites in the equatorial plane has its own unique longitude which is constant for all points on the earth. Furthermore, each dish site on the earth has a latitude and longitude position. With this information the program is able to calculate a reasonably fitting declination angle for each site, **and document the inherent error for each satellite.**

The first step of the program is to figure out the X, Y, and Z coordinates of the satellites. Because the satellites lie in the equatorial plane, our basic reference, their Z values are zero. For reference purposes we have defined the line through the center of earth and passing under the site as zero X. The satellite coordinates, X, or Y, are trigonometrically defined by the distance they are out from the center of the earth (26,200 statute miles), times the Sine or Cosine of the difference between the site longitude and the satellite longitude. The Satellite distance was obtained by telephone from Mr. Jeremiah Salvatore, Department Manager of Hughes Orbital Operations and Analysis Department, who uses 22752.7 nautical miles which contain 6080 feet each. It was independently confirmed by telephone by Dr. William Melbourne, Analytical Scientist at the Jet Propulsion Laboratory who uses 42164.9 kilometers which contain 3280.8 feet each. Both sources' numbers convert to 26200.1 statute miles which contain 5280 feet each.

The next step taken by the program is to find the X, Y, and Z value. In order to calculate these values all the program needs to know is the latitude of the site and the radius of the earth. It derives the answer for Z (the distance above the Y axis) by multiplying the earth radius times the sine of the latitude, and Y (the distance out from the center of the earth) by multiplying the earth radius

Geostationary Satellite Tracking Offset Angles
Along Longitude 107.5 W
Showing Details and Error Magnitudes

Latitude	Offset	Extended Offset	Details	
			Aver. Error	Max. Error
80	8.46	8.46446	.00001	.00003
75	8.31	8.30517	.00002	.00007
70	8.08	8.08352	.00004	.00011
65	7.80	7.80106	.00006	.00020
60	7.46	7.45937	.00009	.00026
55	7.06	7.06154	.00011	.00035
50	6.61	6.60936	.00014	.00044
49	6.51	6.51227	.00014	.00044
48	6.41	6.41412	.00015	.00045
47	6.31	6.31344	.00015	.00047
46	6.21	6.21080	.00016	.00050
45	6.11	6.10625	.00016	.00051
44	6.00	5.99987	.00017	.00052
43	5.89	5.89173	.00017	.00051
42	5.78	5.78151	.00017	.00053
41	5.67	5.66969	.00018	.00053
40	5.56	5.55596	.00018	.00054
39	5.44	5.44034	.00018	.00058
38	5.32	5.32327	.00018	.00058
37	5.20	5.20452	.00019	.00058
36	5.08	5.08401	.00019	.00060
35	4.96	4.96207	.00019	.00058
34	4.84	4.83835	.00019	.00061
33	4.71	4.71344	.00019	.00057
32	4.59	4.58675	.00019	.00058
31	4.46	4.45864	.00019	.00059
30	4.32	4.32124	.00019	.00057
29	4.20	4.19816	.00019	.00061
28	4.07	4.06606	.00019	.00059
27	3.93	3.93257	.00019	.00058
26	3.80	3.79780	.00018	.00058
25	3.66	3.66193	.00018	.00049
20	2.97	2.96550	.00016	.00049
15	2.25	2.24524	.00013	.00041
10	1.51	1.50699	.00009	.00021
5	0.76	0.75674	.00005	.00009

Satellite Orbital Radius: 26,200 statute miles

Mean Earth Radius: 3,959 statute miles

*Gourmet...Entertaining, ARC-SET Manufacturer, (213) 666-2728

times the cosine of latitude. Rand McNally's World Atlas, Imperial Edition, 1968, lists the earth's equatorial diameter as 7926.68 statute miles, the polar diameter as 7899.99, and the mean diameter as 7918.78. Since this analysis is pertinent to the inhabited regions of North America, I chose to use half the mean diameter, 3959 as the earth's radius.

Having found the X, Y, and Z coordinates for both the site and all the satellites, the program now calculates the distance from the site to each of the satellites. This is done simply enough by translating the Pythagorean theorem into the third dimension. For all distances we simply take the difference in coordinates X, Y, Z between a given satellite and the site. The formula is **distance equals the square root of delta X squared plus delta Y squared plus delta Z squared.** After

this step is completed the computer stores away all the distance values by each satellite and it is ready to move on to the main part of the program, in which the angle of the declination will be found.

In my initial program the computer was put into a loop increasing and decreasing the X and Y coordinates for a spot on the equatorial plane below the site. The line passing through the site and this spot was a trial axis. Now, by again using the formula distance equals the square root of the change in X squared plus the change in Y squared plus the change in Z squared, the computer finds

the distance along the trial axis from the site to the intersect spot on the equatorial plane, and the distance from that spot to the satellite. In doing so it has found the remaining two sides of a triangle. By applying the Law of Cosines the computer is able to calculate what I called the crown angle. The crown angle is the angle between the line passing through the satellite and the site, and the line which is our trial axis. The **Law of Cosines** gives the cosine of the crown angle as **equal to** the quantity of the **square** of the distance from site to satellite, **plus** the square of the distance from site to spot, minus the square of the distance

The LND James M. Roberts

The LND is why quotation marks are appropriate in reference to satellite system "polar" mounts. Astronomers' true polar mounts have axes that are truly parallel to our earth's pole of rotation, for looking to far greater distances than our satellites.

The LND is not a new discovery to everybody. Several of us have "discovered" it at different times and through different approaches. Since my son Daniel worked out his unique analytical approach as a scholarship project last winter, we have found that: Steve Birkill of England had developed and published theoretical values in 1978; Bob Bruns, of Chaparral, has been working on another theoretical approach this spring; and the Raydx instructions are close. For all physically measurable purposes the results agree (the differences are only a couple of hundredths of a degree).

If this is the first time that you have heard of the LND, you are not alone. Too few have heard about it, yet too many have worked it into their system the hard way (by trial, error and endless adjustments). Now you have got it!

The LND is important to clear C band pictures across the arc, and vital to Ku band reception from the growing number of those birds.

The LND is a departure from most guides, instructions, mount markings and tables.

The LND is the same for all "polar" mounted dishes, parabolic or spoon.

The LND results in a "new" tabulation of Declination or offset values as listed in Table 3. The values are offered in both angular measure as well as percent of the distance separating the satellite dish mount axis's points of rotation. If angular measure is to be used, a highly precise inclination measuring instrument, such as an ARC SET, or a pair of SAT SETs, will be mighty handy.

"Polar" mounts on Satellite reception systems, which get all of both the C and the Ku birds, have their axes tipped toward the equatorial plane to a slightly greater degree, the **Little Necessary Difference (LND)**, than their local Latitude.

The LND is less than a degree, but it makes a big difference in system performance.

The LND is a reduction in the already small Declination angle, which makes it key.

The LND often makes a difference in choice of Declination holes, or shims, which are much harder (and sometimes dangerous) to change after the dish is on the mount.

The LND is evident in Table 2, where the Axis values are higher than their Latitude.

TABLE 3
Declination (Offset) Values For Americas
(Longitude 110 W +/- 55)

Lat	Degree	%	Lat.	Degree	%	Lat.	Degree	%
80	8.47	14.83	52	6.80	11.89	32	4.59	8.02
75	8.31	14.55	51	6.70	11.72	31	4.46	7.79
70	8.08	14.15	50	6.61	11.56	30	4.33	7.56
69	8.03	14.06	49	6.52	11.40	29	4.20	7.34
68	7.98	13.96	48	6.42	11.23	28	4.07	7.11
67	7.92	13.86	47	6.32	11.05	27	3.94	6.88
66	7.86	13.76	46	6.21	10.86	26	3.80	6.64
65	7.80	13.65	45	6.11	10.68	25	3.66	6.39
64	7.74	13.55	44	6.00	10.49	24	3.52	6.15
63	7.68	13.44	43	5.89	10.30	23	3.39	5.92
62	7.61	13.32	42	5.78	10.10	22	3.26	5.69
61	7.54	13.19	41	5.67	9.91	21	3.12	5.45
60	7.46	13.05	40	5.56	9.72	20	2.98	5.20
59	7.38	12.91	39	5.45	9.52	19	2.83	4.94
58	7.30	12.77	38	5.33	9.31	18	2.68	4.68
57	7.22	12.63	37	5.21	9.10	17	2.54	4.43
56	7.14	12.49	36	5.09	8.89	16	2.39	4.17
55	7.06	12.35	35	4.97	8.68	15	2.25	3.93
54	6.98	12.21	34	4.85	8.47	10	1.51	2.64
53	6.89	12.05	33	4.72	8.25	5	.76	1.33

% is the percentage of distance between pivot points of mount's axis, which is to be added to dish stand-off at top pivot point, or which is to be deducted from dish stand-off at bottom pivot.

Satellite Orbital Radius: 26,200 statute miles

Mean Earth Radius: 3,959 statute miles

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from spot to satellite; **divided by** the quantity of twice the distance from site to satellite **multiplied by** the distance from site to spot.

After having found a crown angle for each triangle formed with each satellite the computer was then instructed to find the average crown angle. It was instructed to compare this average crown angle with each of the individual crown angles and find the difference between them, or

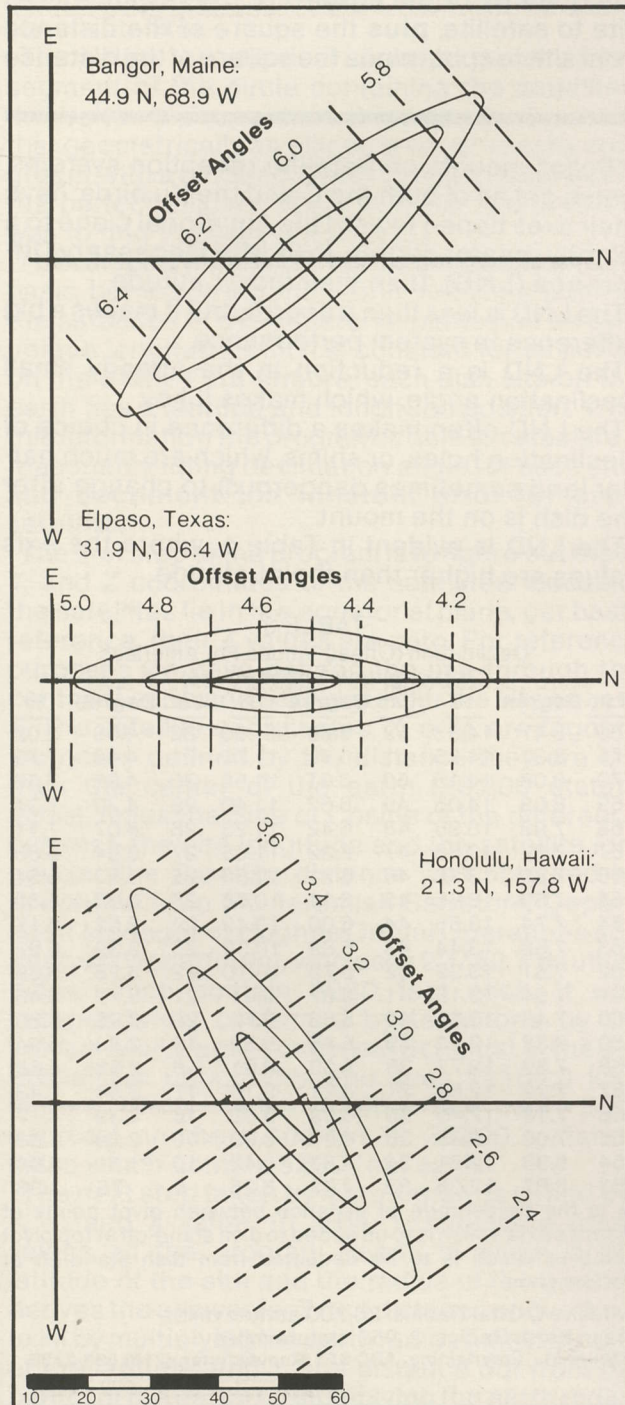


TABLE 2

Axis and Zenith Inclinations For Americas
(Longitude 110 W +/- 55)

LAT.	AXIS	ZENITH	LAT.	AXIS	ZENITH	LAT.	AXIS	ZENITH
80	80.22	88.69	52	52.68	59.48	32	32.66	37.25
75	75.33	83.64	51	51.69	58.39	31	31.64	36.11
70	70.43	78.52	50	50.69	57.31	30	30.63	34.06
69	69.45	77.48	49	49.70	56.21	29	29.62	33.82
68	68.47	76.45	48	48.70	55.12	28	28.61	32.68
67	67.49	75.41	47	47.70	54.02	27	27.59	31.53
66	66.50	74.37	46	46.71	52.92	26	26.58	30.38
65	65.52	73.32	45	45.71	51.82	25	25.57	29.23
64	64.54	72.28	44	44.72	50.72	24	24.56	28.08
63	63.55	71.23	43	43.72	49.61	23	23.53	26.92
62	62.56	70.17	42	42.72	48.50	22	22.51	25.77
61	61.58	69.12	41	41.71	47.38	21	21.49	24.61
60	60.59	68.06	40	40.71	46.27	20	20.47	23.45
59	59.61	66.99	39	39.70	45.15	19	19.45	22.29
58	58.62	65.93	38	38.70	44.03	18	18.44	21.12
57	57.64	64.86	37	37.69	42.90	17	17.42	19.96
56	56.65	63.79	36	36.69	41.78	16	16.40	18.79
55	55.66	62.72	35	35.68	40.65	15	15.37	17.62
54	54.67	61.64	34	34.67	39.52	10	10.26	11.77
53	53.67	60.56	33	33.67	38.38	5	5.13	5.89

Satellite Orbital Radius: 26,200 statute miles

Mean Earth Radius: 3,959 statute miles

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each crown angle's error. It then printed out the average crown angle and the average and maximum error, or difference, for that particular spot's X and Y before returning to try another spot. This allowed a plot to be made which revealed some interesting information (see figure 1). When the errors at each spot's X and Y were contoured, for many widely different sites, **the smallest error always was found on the Y axis.** This discovery allowed a major step to be made in simplifying the program. Instead of having the computer try different X and Y values for a matrix of spots under the site, the computer was set up to try different values for Y alone.

With the simplification of this step the program was then modified to allow the computer to do a search along the Y axis until the best fit (least average, or maximum error) crown angle was found for all the satellites, from any given site (latitude and longitude).

Once it determines what the best angle is, the computer subtracts that crown angle from ninety degrees, to allow us to know what the measurement is from the normal to the conical axis of rotation. This is our angle of declination (see table 1).

Because the program was designed to pre-set a tool for arcing dishes the program calculates the dish mount's true axis in a manner mindful of the way the tool is used and set. It looks to the southerly intersect of the Clark belt, the belt containing the satellites, and calculates the local elevation angle for that intersect. For the tool that

angle is called Zenith, for at this orientation the dish is at the Zenith of axis angle, the computer simply subtracts the computed value of declination from this Zenith angle (**see table 2**).

From the print out of the basic numbers for the axis angle and the declination angle we could now for the first time see which way, south, and how far to tilt the dish axis in order to achieve a best fit ellipse. The difference between my numbers and those widely published in the satellite

industry stands out as the difference between the Latitude and Axis values in **table 2**. Because of the tightness of the search pattern even the maximum errors involved are negligible (as noted on **table 1**). It is also important to state that because of the method I utilized in this program, **it will not become dated** as new satellites are added in space; all that need be done is to **enter their name and longitude** to the data statements and increase the looping commands.

DEALER SERVICE BENCH

by Alli Lake of Satellite Link, Inc.

END Of WGN Sub-Carrier Era

For almost as many years as there has been a home dish industry, there has been high interest in creating home TVRO receivers which produced high fidelity audio reception from the ever growing list of FM sub-carrier services found on satellite feeds such as Tempo (F3R, TR6) or WGN (G1, TR3). These sub-carrier services ran the entertainment gamut from country and western, classical and top 40 programmed audio services to religious scripture and the latest books and magazines read aloud for the enjoyment of the blind. Safeway stores, various drug store chains, and even computer graphics are now set on sub-carrier FM audio. The pioneer in all of this has been United Video which operates the WGN/KTVT/WPIX services. United found early that by very careful engineering and planning, they could add extra audio and data sub-carriers to video transmissions such as WGN and produce additional revenue for themselves. This proliferation of audio sub-carrier services spawned a miniature industry within the home dish and commercial dish market as designers scrambled to create special audio sub-carrier tuners which tune in the special narrow band services located between the top end of the video on a video transponder and the upper limits of the transponder itself. Originally, most such narrow band transmissions were confined to the region between 5.5 and 7.0 MHz. As the needs grew and the technology grew better, the audio sub-carriers migrated outward so that today they are found between 5.0 and 8.5 on many video services.

Certainly one of the most TVRO listener popular services, if not indeed THE most popular service, is found on Galaxy 1, TR3. There more than 16 separate audio sub-

carrier and data services have been providing music, news and information for nearly five years. Alas, it is now coming to a close and most of the receivers out there which routinely tune in these sub-carrier transmissions will find one day soon that the transmissions have disappeared.

Scrambling is the cause of all of this. For United Video to scramble the WGN video service, using Videocipher and to satisfy the demands of the cable industry, they were faced with a series of serious problems. Scrambling the WGN video would create a situation which would make the audio sub-carriers also transmitted on transponder 3 virtually unusable. Tests run by M/A-Com and United Video (reported in detail in **CSD/2** for August 15th and September 15th, 1985) indicated the seriousness of the problem. Either M/A-Com had to modify its Videocipher system or United had to move its sub-carriers. There were several possibilities; United could pick up the 16 plus subs and transfer them to another satellite, such as F4, tacking them onto some video service that would never be scrambled. But United's WPIX (F4, TR19) and KTVT (T303, TR22) were also scheduled to be scrambled. More than 1,000 commercial receive sites would be impacted by any move since some of the audio sub-carrier services had hundreds of commercial customer-users.

The engineering department at United had a different view on solving the Videocipher created problem. While M/A-Com was insisting that they could handle all of the WGN sub-carriers by making small changes in Videocipher, the United engineers were worried that the vast amount of sub-carrier data would create never-ending problems with the Videocipher encryption scheme. They felt the practical solution was to get the sub-carriers as far away from Videocipher as possible.

They created a new type of service, using transponder 13 or Westar5 and since mid-September the service has been in full time operation as a parallel feed to the present service still found on Galaxy 1, TR3. The service is called 'SCS' and it involves transmitting a plain CW type of carrier in approximately the middle of the channel. The CW or continuous wave signal is not video modulated; rather it simply provides a reference or 'marker/carrier' to which they have added a new breed of audio sub-carriers. And that is the crux of the problem facing users of this service in the home dish industry. Rather than filling 80% of the transponder with video modulation, and then offsetting the audio sub-carriers by 5.0 MHz or more from the baseband video carrier frequency, the new SCS package can start stacking up the audio sub-carriers within the first 1 MHz of the marker/main carrier.

As a practical matter, your TVRO receiver audio demodulator (whether inboard or outboard in its own container) tunes from approximately 5.0 MHz to approximately 8 or 8.5 MHz. When you tune to transponder 13 or W5, you will find a graying of the screen on the television set and you are unlikely to find ANY sign of audio sub-carriers unless your demodulator extends down right to 5.0 MHz where you will hear either an unmodulated carrier or a talk radio show format radio network feed. All of those other familiar WGN sub-carrier sounds, such as Satellite Music Network, Moody Broadcasting, Country Music Network, WFMT and others are 'gone'. Where are they???

First you have to get inside of the satellite receiver audio demodulator, or inside of the outboard sub-carrier tuner. The challenge is this; modify the tuning range for baseband audio from its present 5.0-8.5 MHz to 0.1 to 5.5 MHz. In other words, **shift the operating frequency** of the sub-carrier tuner downward to cover this new frequency range.

This should result in an entire new breed of satellite audio systems:

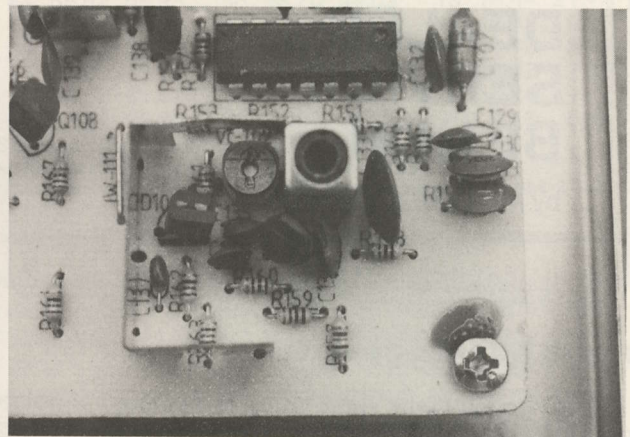
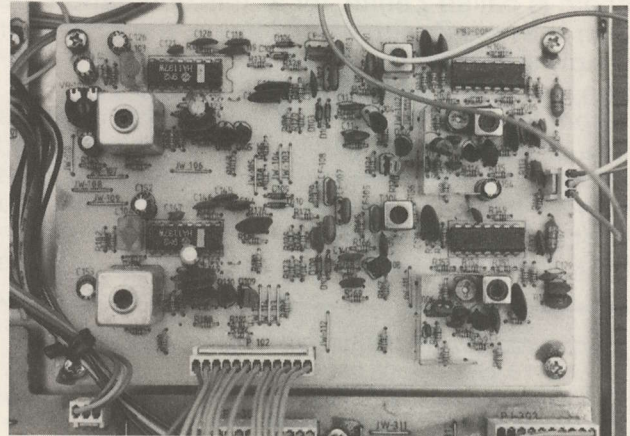
- 1) For now, until WGN is scrambled full time, the sub-carriers fed on Galaxy 1, TR3 will stay in place. When WGN is full time scrambled, they will simply disappear.
- 2) To tune in the 'normal' audio sub-carriers we are all familiar with, receivers will need to tune the 5.0 to 8.5 MHz region.
- 3) To tune in the 'new sub-carrier range' being pioneered by United Video, receivers will have to tune in the frequency range 0.0 (0.1) to 5.5 MHz or so.
- 4) Most of the sub-carrier services you will find on W5, TR13 will be (relatively speaking) 'narrow band' in bandwidth. Some will, however, be more narrow band than others. A fully frequency agile as well as bandwidth agile tuner will be very useful.

United is on new ground here, pioneering a new format of audio or data service which early reports suggest will be a tremendous boost to low-cost audio and data networking. United had hoped for a 36 dBw footprint in the midwest, at the approximate center of their boresight. They have measured **39 dBw footprint** levels at the center, opening up their narrow band service to four foot dishes in places such as Chicago and Atlanta. The service is expected to have no fewer than 50 separate audio and data customers by the first of the year (nearly 3 times as many as the present WGN sub-carrier service on Galaxy 1), and United is even talking about leasing a second transponder to offer another 50 or so channels to additional audio and data networks.

QUICK Testing

Most audio sub-carrier tuners set the 5.0 to 8.0 (etc.) tuning range with a combination of tuned circuits. The tuned circuits consist of wire wound coil forms, slugged tuned for the appropriate (5-8 MHz) frequency range. Some units tune using varactor tuning diodes slaved to stepped tuning voltages.

You can force the tuning range on some units (we selected an Astro-Pro audio tuner for our first tests) by simply screwing 'in' (running down) the slug in the input tuning form. This will drop the tuning range from 5 MHz on the low end to perhaps 2 or 3 MHz, depending upon the unit involved. To tune in **the entire range** you need



ASTRO PRO stand alone sub-carrier demodulator was 'forced down' in tuning frequency by simply screwing down (clockwise) all of the slug tuned forms and then readjusting the trimmer capacitor found across the input stage. New tuners will be required by the industry; a new product line!

to **replace** the slug tuned forms with lower frequency forms; you may get by for test purposes by simply rewinding the coil around the form with 50 to 60% more wire, replacing the present coil winding with new wire that is longer by perhaps 50% and then tying it back to the top and bottom points on the coil form just as it came off.

Our tests, at the CSD/WIV Lab in the Turks and Caicos Islands, indicated that the signal levels present on W5, TR13, are indeed 'stout'. The audio signal to noise ratio is from 10 to 12 dB better on Westar than on Galaxy 1, and the audio fidelity is quite superior.

A new world of satellite audio is coming, soon. United Video is pioneering a system that may revolutionize the way 'high power C band' narrow band services are distributed over North America. This will put new life back into the TVRO audio receiver business creating new challenges for receiver designers who have managed by phase locking their receivers to the abundant video signals usually found on audio carriage transponders. Progress in technology never ceases and United has a winner here.

INDUSTRY AT LARGE

CORRESPONDENCE, NOTES, REBUTTALS AND CHARGES . . .

CST provides this industry 'forum' for the purpose of allowing members of the industry to comment on industry activities. CSD assumes no legal responsibility for statements made here and those providing such communications are held liable for their statements directly.

POLITICAL Clout

Enclosed you will find a copy of the Home Satellite Industry Protection Act with comments written by Frank Grzwacki, Congressman John Dingell's opponent in the 16th District race in Michigan. It is imperative that the trade journals, dealers and consumers rally behind Frank's campaign so we can send a strong message to Congress that we, the TVRO users and businesses, will no longer sit back and drag our feet on this issue. Congressman Dingell has been in office 30 years and his father held the same seat for 22 years prior to this. He is the 16th member of Congress based upon seniority and it has been said that because of his position and tenure he is the fourth most powerful man in Congress. If we can succeed in removing him from office, I believe we will have gotten the attention of other members of Congress as well.

Bernard J. Schafer
Michigan Microtech, Inc.
2185 E. Remus Road
Mt. Pleasant, Mi. 48858

Schafer and others are discovering that when normal means of persuading a Congressman fail, the ballot box is the ultimate weapon. Dingell's position allows him the opportunity to squash many of the House inspired bills and hearings regarding TVRO. To date, he has maintained a seemingly neutral role taking neither a for nor against posture. Some TVRO people have taken this position to mean he really supports a status quo; or, a continuation of cable domination of programming access. Many people in Michigan are working to have Dingell defeated in this fall's elections as a means, as Schafer says, to 'get the attention of Congress'. There is another side to this sort of effort of course; if Dingell does win reelection, he could well 'remember' his problems with TVRO through his full next term.

NASTY Telephone TI

I watched with great interest your recent series of 8 reports on Boresight (and Satellite Showtime) which dealt with the nitty-gritty operational aspects of the spectrum analyzer; in particular the AVCOM PSA-35 unit. I believe that series deserves overall excellent marks for being clear, concise and well done. However, you fell into a trap on a point you may not be aware of. When you were interviewing the GTE telephone engineer in Kentucky, speaking about the traffic loading of his baseband during off-peak hours, he mentioned that they run -20 dB 'pilots' on each channel. Having personally taught a class in Vietnam many years ago which we called 'dB, dBm and Loading' I knew the engineer was pulling a fast one. Unfortunately, in your summary after his double-talk, you picked up on what he said and amplified it. So while you attempted to straighten out his 'facts' so the average dealer could understand what he said, without all of the high level engineering talk, you bit on his misinformation and made it worse!

Telco uses something called 13 dBMO loading as a factor on their message basebands. Western Union, by comparison, has more data and they are 2 dB more conservative than Telco. So when there is an 'on-hook' 2600SF tone of -20 dBMO, there is a 7 dB difference in power on an analog beam, depending upon the time of day and usage. Based upon my own back yard observations, when I have heavy TI 'splatter' from the trees, there is a definite time-of-day correlation which roughly corresponds to what I know to be heavy usage hours.

This may be a 'minor point' in the overall scheme of things for a new installer, but I would hate to put in a system on a Sunday night with a filter for 'light sparklies' and then on Monday morning have the boss chew me out because he had an irate customer with a black screen on six transponders.

Finally, welcome back to Bob Cooper; now I know for sure my own skies will not go dark!

Tim Alderman
1005 53rd Street
Oakland, Ca. 94608-3101

We should have interviewed Tim rather than the GTE engineer in Kentucky. A 7 dB difference between light and heavy loading, in spite of the statements of the Telco engineer to the contrary on the Boresight/Showtime series is certainly significant (if you had 7 dB more signal from Galaxy 1, for example, you could drop from a 6 foot dish minimal system to a 2 foot dish!). The reverse is true with TI; 7 dB more TI than you expected would eat your lunch when you thought you were filter-clean. Beware; don't put in traps on weekends or after regular telephone company business hours unless you stick in more trap than you think you really need. Thanks Tim.

NAUGHTY-Naughty

It has come to our attention that some home TVRO owners are considering the purchase of so-called 'Black Boxes' that are purported to descramble subscription services without payment of any programming fees. In actuality, these black boxes are turning out to be VideoCipher II consumer descramblers that have been authorized to receive scrambled services. However, dish owners will discover that these units will function for only a few days or weeks — (just) long enough for the salesman to disappear.

HBO would like to caution all dish owners to guard against this unlawful and often costly practice.

Let me reiterate that we do not have the necessary programming rights to offer HBO and Cinemax subscriptions to home TVRO owners living **outside** the United States. Therefore, if the problem occurs in Canada or Mexico, dish owners would be unable to use the 'black box' to order scrambled services like HBO and Cinemax. Please advise your readers to protect themselves from these opportunists whose profit is being

made at the home TVRO owner's expense.

Robert N. Caird
HBO/Home Box Office, Inc.
1100 Avenue of the Americas
New York, New York 11036
(212/512-5951)

Caird, VP of 'Direct Broadcast', is concerned that interest in breaking through the Videocipher scrambling system may be reaching a fever pitch. It is of some amusing interest that HBO maintains from a legal position that their C band transmissions are not 'broadcast class signals' since one of the sacred definitions of 'broadcast' is that the service being broadcast is routinely available to anyone equipped with the appropriate receiver equipment. HBO has filed pleadings with the FCC arguing that their signals should not be treated as 'broadcast signals' under the FCC's rules, but rather as point to point privately owned signals. Yet his title makes him VP of 'Direct Broadcast' and he heads up the group that is responsible for the selling of home dish services. Is it possible Time, Inc. lawyers let one slip by?

REDUCING Interference

In pursuit of a project on a client's behalf, I am searching for published articles explaining how to cure TVI (television interference) within the boundaries of a TV channel, without having access to the transmitter responsible for the interference. For example, the second harmonic of a 10 meter amateur transmitter would fall between 56.0 and 59.4 MHz, or at channel 2 video frequencies (after demodulation) between 0.75 and 4.15 MHz. The third harmonic of a 15 meter transmitter would fall between 63 and 64.35 MHz, or at a channel 3 video frequency between 1.75 and 3.10 MHz. The fourth harmonic of a 20 meter transmitter would fall between 56.0 and 57.40 MHz, or at channel 2 video frequencies between 0.75 and 2.15 MHz.

It occurs to me that during the time Bob Cooper published **DXing Horizons Magazine**, or subsequently, perhaps articles dealing with building traps for this situation were published. I am not interested in transmitter harmonic traps; there are plenty of them in the ARRL Handbooks. Also, I am not interested in out-of-channel receiver traps; for example, image reject filters for trapping fundamental leakage into VHF receivers with 21-27 MHz IFs, or dual heterodyne UHF receivers with the first IF in the 144 MHz region. Can you help?

Archer S. Taylor
Malarkey-Taylor Associates
1301 Pennsylvania Avenue
N.W., Suite 200
Washington, DC 20004

The answer is simple but the application may be difficult. Agreed, the proper place to stop transmitter harmonic radiation is at the transmitter itself. Harmonic filters do this job by stopping the passband escaping to the antenna (or radiation device) just above the operating frequency, effectively rolling off the non-desired (higher) multiples of the transmitter output frequency. When you don't have access to the transmitter to stop the problem, you have to trap out the interfering carrier after it appears in and is mixed with the TV channel of interest. This is not difficult when you have a stable, although perhaps unknown-in-frequency interfering signal source. Coop created a 'TVI Booklet' for the FCC in 1973-74 and from that came a set of (now out of print) wall charts which explain curing the problem. If you are unable to locate these self-help wall charts or the TVI Booklet through the Washington FCC office, try this. Hang a section of 300 ohm flat line or coaxial cable line across the terminals into the TV

receiver/demodulator. Start with a line that is approximately 10% longer in length than the half wavelength of the suspected interfering carrier, taking into account the velocity of propagation of the cable in use. Then snip off small increments, such as 1/4 inch, and observe the effect. As the line is trimmed ('tuned') to the carrier frequency of the interfering signal, the section of line will act as a trap and suck out the interfering carrier. A similar trap could be built ala the tuneable Jerrold or Blonder Tongue head-end adjustable traps to go in line (in series with the antenna downlead) between the receiving antenna and the receiver/demodulator input. Unfortunately, if the example you give is more than an example, and the source of interference is an amateur transmission, this will only work when the transmitter in question is operating on a frequency which matches the tuned trap. Amateur operators are not assigned frequencies; they are assigned 'bands' and they are free to adjust their transmitter output over any frequency within the assigned band. The amateur ten meter band, for example, may have an amateur operating between 28.5 and 29.7 MHz. The second harmonic of this falls from 57.0 to 59.4 MHz, or over a wide (2.4 MHz) portion of channel 2. A trap adjusted to suck out interference at 57.4 MHz will not do any good if the amateur moves his transmitter operating frequency to 29.0 because now his second harmonic will fall at 58.0 MHz. Although you say you have no access to the transmitter, perhaps you had better find a way to gain access since you cannot stack up traps for every possible operating frequency the amateur may select. Remember, each trap costs you a small amount of lost channel 2 spectrum as well, and this may lead to a washed out picture or no color after the 'cure'. Oh yes, Mr. Taylor was coauthor of the NCTA (National Cable Television Association) study published in May of 1985 which identified that 35% of all TVRO dishes being sold at the time were going into cable-available areas. From that 'study' came the resolve in the cable industry to scramble all satellite fed signals, as soon as possible. Mr. Taylor was a pioneer cable operator in the northwestern corner of the United States starting in 1952 and is a much respected engineer in his field.

WILL NOT Get Involved In Scrambling

I have just returned from a four week trip to the U.K. where I saw a demonstration of a new Inmarsat Standard C earth station that weighed just 12 pounds. The entire family went with me to England and it was a nice holiday as well as a chance to get away from some of the problems here. At the moment things are quiet and we hope they won't get any worse. My dish system is continuing to work fine and the Russian satellite signals continue to blast in.

I recently received a letter from a Mr. William Chester of Fresno, California asking me to get involved in the scrambling debate; that is a fight I wish to keep out of, even if I had the time for such a thing. My best to everyone in the (home dish) industry, none the less.

Arthur C. Clarke
25, Barnes Place
Colombo 7,
Sri Lanka

There has been concern that Clarke's continued safety in Sri Lanka was in some jeopardy because of the fighting occurring there. A group of 'separatists' called Tamils, originally migrating to Sri Lanka from southern India centuries ago, are demanding political independence for a portion of the country. Bloody fighting in the north of Sri Lanka as well as occasional forays into the capital where Arthur C. lives has made living in Sri Lanka much less than the 'tropical paradise' which we visited in the fall of 1983 when 25 people representing the US, Canadian and

Japanese TVRO industry traveled to visit Clarke and install a trio of large dishes as gifts from our industry. His continued safety is a matter of concern for us all.

HIDDEN Addresses?

I have watched Bob Cooper on Boresight and I would like to know its broadcasting schedule so I do not miss any of these programs. I intend to buy the equipment to allow me to receive everything transmitted by satellite, scrambled or unscrambled, video, audio or data. I have purchased volumes 1 and 2 of the 'Hidden Signals' book but the method by which these books and other materials are shipped in this country concerns me. Everything is shipped via UPS these days and that means records are kept of who buys what. Somebody needs to start a remailing service for the TVRO field so that these records are not available to federal snoops. I have an extensive computer system and routinely order computer programs from outside the USA which often cost as little as \$8 each; whereas the original programs sell for \$500 or more in the US. This is a problem that needs to be addressed.

C. Richard Matthews
(Someplace in Kentucky)

In this great big world there are those people who are creators and those who are users. And in the world or users there are at least two subgroups; those who respect the time, energy and talent which creators put into products and those who do not. Matthews is obviously a part of our culture who 'does not'. Our industry will do itself no good whatsoever to be identified as a group supporting the 'those who do not' subculture. As the scrambling hackers heat up the war zone against M/A-Com and others who would scramble everything in sight, we should not lose sight of our goal here; equal and open access to programming, at fair and nondiscriminatory pricing.

FROM BRUSSELS With Love

I am stationed in Brussels, Belgium and am very interested in setting up a TVRO system for my home to receive the Armed Forces TV network signal. Unfortunately, TVRO has not developed very extensively in Europe yet and I have not been able to locate information on satellite locations, transponder number and frequency, signal technical parameters or European laws governing TVRO use. Do you have any of this information available, or know where I can locate same? I have read everything I could get my hands on regarding US TVRO but there is a total lack of information from Europe about the possibilities here.

Stanley S. Leja
NACISA
APO New York 09667-5381

Not true. An excellent European publication called 'Satellite TV Europe' is published by 21st Century Publishing, 531-533 Kings Road, London SW10 0TZ, UK (telephone +441 351-3612). STVE is published by Colin McGhee, a very bright chap who recently visited the US to attend the fall trade shows here. McGhee has made his publication international in scope, is launching trade shows for Europe during 1987 and has sparked the formation of an international trade association of dish dealers, users and programmers. He feels that the divisive scrambling battles which had torn asunder the North American dish industry can be avoided in Europe by putting the programmers into the same trade association as the viewers and users right up front, as the new European TVRO industry is being launched. Certainly our North American 'example' has provided Europeans with an example of how not to do it and their direction may historically prove to be the right one.

TREMENDOUS Demand For Black Boxes?

As a concerned satellite dish owner, I was very intrigued by Bob Cooper's discussion on the Boresight program August 21st with Mr. Doug Dehnert of USS/Maspro. I learned a great deal about the special problems faced by receiver manufacturers and designers in that program segment and I applaud those who put it together. It is too bad that every dish owner could not see such a discussion because it certainly helped me better understand the problems.

It is my belief that if some electronic experts could create a 'black box' system that worked, reliably, there would be a tremendous market for the units. I would consider a reasonable price for a box that unscrambled everything to be in the \$400 to \$500 range. I know that I would certainly be an interested dish owner/buyer in spite of Mr. Dehnert's assertion that 'most dish owners are willing to pay \$20 to \$30 per month to receive scrambled transmissions'.

My local satellite TV dealer recently told me that I could purchase a M/A-Com Videocipher descrambler for \$400, have it authorized by scrambled program services like HBO, Cinemax, Showtime, The Movie Channel and Headline News and then have the addressable chip set removed. The result, he said, would be that I could then continue to receive these programs without paying for them. However, he then suggested that I wait until next year to purchase a descrambler when more programming services would be available using the Videocipher system. In the September 1986 issue of ORBIT magazine, I read that M/A-Com engineers have planted so called bombs in the Videocipher's software that would wipe out any sensitive data when the descrambler is tampered with. Is this factual?

As very concerned dish owners, my wife and I attended the Satellite Earth Station Day in Washington last October 29th. We also attended the July 31st hearings in Washington. I thought these hearings were interesting and the time well spent, but I saw no hint that some sort of useful accommodation would be reached after the hearings were concluded.

Eugene Cervone
1056 E 96th Street
Brooklyn, New York 11236

Videocipher units maintain a data memory with a small Lithium battery which insures that factory inserted instructions in software are not lost when a unit is being transported or is turned off for a period of time. Key proprietary chip devices, such as 'U7', a microprocessor chip that plays a major role in the proper operation of an addressed Videocipher unit, are so protected. To remove this chip from the socket, you disconnect the battery power and as soon as that happens the chip 'forgets' everything the factory taught it. The information can only be reinserted by M/A-Com, or, by a talented hacker who has figured out how to reload the microprocessor memory with the proper instructions. Without those instructions, a unit disabled by having U7 unplugged from its memory retention battery is useless.

As an aside, it was the belief of most Videocipher researchers that it was essential for the RAM (memory) contained inside of U7 to be 'read out' directly from U7 before the complete mysteries associated with Videocipher could be unraveled. It was further believed that to read out the RAM portion of the memory, one had to 'enter' U7. And U7 is 'sealed' against unauthorized entry. To gain entry, U7 had to come off the circuit board but if that was done, the battery would be disconnected and the memory inside would be lost. A true 'Catch 22' situation. The problem was resolved when researchers discovered the contents of U7's RAM could be read out through U30 as well so U7 did not have to be removed after all. (The things you learn by reading CSD's Correspondence Section!)

TRANSPONDER WATCH

RECENT REPORTS OF ACTIVITY ON DOMESTIC / INTERNATIONAL SATELLITES

Send your reports to CSD Transponder Watch, P.O. Box 100858, Ft. Lauderdale, FL 33310. For late news, call (305) 771-0505.

TELECONFERENCE originated Miami and sent to medical personnel in Caribbean, central and south America scheduled via Intelsat, Brasilsat and other birds October 21-24 (Child Survival and Health), November 6-8 (Maternal and Child Care), January 25-29 (Continuing Education in Pediatrics). Information 305/666-5422.

WESTERN Union has final FCC permission to utilize transponder 16, Westar 5 to distribute programming to Caribbean. CSS (Caribbean Super Station) had interim approval for such a service. CSS operates 24 hours per day from northern Florida uplink, is seeking arrangements to uplink from off-shore location in 1987.

RCA AMERICOM is exiting private line data service business via satellite. Seventeen transponders on F1 R will be vacated in close down of service.

FCC upset over article appearing in 'Mother Jones Magazine' which purports to show readers how to jam satellites for investment of \$5,500. Article is similar in concept to one appearing in October 1986 issue of Radio Electronics, both focusing on relative 'ease' of attacking satellites with 'off the shelf' equipment.

SCRAMBLING: ESPN plans to begin tests November while WGN from United Video plans testing as early as latter half of October.

SOUTH AFRICA now distributing SABC-TV service on transponder 1, Intelsat at 60 east using full transponder format. Also on service are up to five audio subcarrier services from South Africa FM stations. Footprint in southern portion of African continent reported to be 29 dBw but the service is using B-MAC encryption and Plessey Australia is supplying their model 2001 receiver to authorized users.

ARIANE flights to launch new spacecraft will not restart until March (1987) according to latest predictions. Date-certain restart has been changed several times following destruction of May 1986 launch.

BURLINGTON Coat Factory Warehouse with 85 locations is acquiring a two-way satellite communications system from Equatorial Communications. Seventy sites are to be installed prior to the end of this year.

GALAXY 3 could become latest 'cable bird' if marketing plans underway at Hughes produces desired results. Between 12 and 18 of the G3 transponders may end up being home for services such as The Weather Channel and C-SPAN sometime in 1987.

USA TODAY is now being transmitted to regional printing plants via ASC1, having started on Westar 3.

DBSA, proposed merger partner for SPACE, has completed (350 page) report titled 'Report on Technical Standards', focusing on problems faced by 12 GHz or Ku-band direct broadcast satellite services. Report available from 804/424-7777.

PAN-AM Commercial Services, not related to Pan Am Sat nor Pan American airways, has acquired space-retrieved Westar 6 satellite; plans to place it over Pacific as privately owned

regional satellite available to Pacific basin users. Scheduled operational date in 1988; ahead are usual problems with Intelsat and various governments in Pacific who will need to approve use of satellite by firms or individuals.

WESTERN Union has signed 'letter of intent' to have its Westar 6-S (replacement) satellite launched by PRC's Long March launch system. After failure of Shuttle, 6-S which had been scheduled for June ('86) launch was left launchless. Chinese say they will launch 6-S during first six months of 1988. Rescheduled Shuttle launch, Ariane launches would have come later. 6-S will replace Westar 3 which is presently expected to 'expire' by mid 1988.

FAA (Federal Aviation Administration) forecasts that satellites will provide bulk of all air and sea navigation communication by 1995. No presently operating satellites serve this function but extensive planning to create new breed of satellites capable of receiving transmissions in UHF band from ships and planes is on drawing boards and numerous companies are in running to gain FCC permission to provide such services.

CBN has answered critics that it has been coerced into scrambling, against its wishes, by cable MSOs. Firm says scrambling is only way they can protect their 'rights' as syndicators and producers of television programming and they deny their decision to scramble was based upon threats received from cable MSOs.

TRW has received contract for \$205M from NASA to create first robotic controlled space maneuvering vehicle. The 'OMV' gadget is expected to operate at altitudes more than 1,500 miles above the present Shuttle, allowing more efficient satellite and deep space probe launches. Operational date is in early 1990s.

TURKEY receiving unusual dual purpose space communications system in combination with program to allow American military bases there to access Intelsat transmissions from AFRTS. Under new package being created by S-A, Turkey bases will downlink AFRTS on C band on 11 meter antennas in two locations. Then it will be re-uplinked to approximately a dozen locations, on a separate transponder and satellite. At the same time, the Turkish domestic communications network will receive around 100 Ku band receive sites and a Ku band uplink site which will carry the Turkish television service nationwide as well as some radio networking. S-A values the total contract at \$8M and plans completion of the system by mid-fall.

TVRO Distributors, hoping to break logjam in third party selling of TVRO software, have formed 'Committee for Programming Access (CPA)'. Warren Supply's Ralph Warren (South Dakota) is chairing group and information is available (Suite 775, 1225 K Street NW, Washington, DC 20005).

S-A took \$16M 'write-down loss' in move to restructure operations and hopefully improve long term investor growth and return in the company. The company is also getting out of

some aspects of its business with home TVRO on the possible list of areas to be dumped.

PHASED-ARRAY antennas (PAA), first announced in home TVRO by Colorado firm last spring, receiving increased attention. Dealers in TVRO have been asked to pay an upfront fee to acquire 'exclusive franchises' for distribution of PAAs in their areas; franchise territories based loosely on established automobile territories for dealers/distributors. Some funds from TVRO investors have been paid, leading to speculation about integrity of firm behind project. Phasar Corporation, Lakewood, Co. now says it will be developing PAA antennas for VSAT applications (transmit and receive) as well as previously announced home dish field. Firm says it has created breakthrough in materials and processing, makes no claims for new antenna technology per se. Primary advantage to antennas, IF they can be made to work and can be delivered in commercial quantities, is flat appearance (5 foot square, 2 inches thick) and light weight (20 pounds).

BROOKS Satellite has filed for protection under Chapter 11 of the federal bankruptcy act. Firm says failure is not related to progress of TVRO sales and installation (terming business 'good') but rather to complicated tax problems related to associated firm called 'Nationwide Power' which merged with Brooks this spring. IRS reportedly is seeking \$10M in back taxes from Nationwide. The status of existing Brooks franchisees is unknown.

STUDY by firm calling itself CSP International of 203 existing owners of home TVRO reports 72% of home dish owners do not plan to purchase a descrambler and only 17% say they will; rest are uncertain. Study also revealed that of those TVRO owners who purchased a home dish system after January 15th, 36% say they will buy a descrambler.

HOLIDAY INN's Hi-Net Communications has given away 200

C band dishes in move to clear old inventory of previous 4 GHz terminals. Hotel chain has essentially completed move to Ku band system using GStar and dishes were given to nonprofit groups including hospitals, churches, and schools.

TELECON VI/ sixth annual teleconference user meeting scheduled for October 27-29 in Anaheim, California; details 415/820-5563.

TVRO concern that when F3R and Galaxy 1 'expire' in 1990-92 time frame, if indeed not prior to those projected dates, cable programmers will have moved majority of high interest programming to Ku band birds (such as RCA/HBO owned Ku-3). Congressional efforts seem to be focusing on clearing up home dish viewing rights for present (C band) satellites only; SPACE and others maintain that unless new (proposed) laws nail down home viewing rights at both C and Ku bands, cable programmers could in theory 'slip away' from mandatory access to home dish owners by migrating to Ku band. HBO counters that it has every 'intention' of remaining available on C band but home dish industry fears it may happen unless Congress covers all bases.

K-MART Ku band system using GTE Spacenet will be using packet assembly method of data transfer. K-Mart anticipates being operational at more than 2,000 store locations by early 1990s.

USIA Worldnet daily transmission, typically two hours, consisting of news programs created by USIA in Washington and interviews and background reports on important news items of day, now being retransmitted via Brazilian national satellite system to Central and South American countries. Service began distribution to Europe two years ago, is now carried widely in Europe by cable and broadcast services for at least news reports.

SOCIAL Security Administration (SSA) wants to install video

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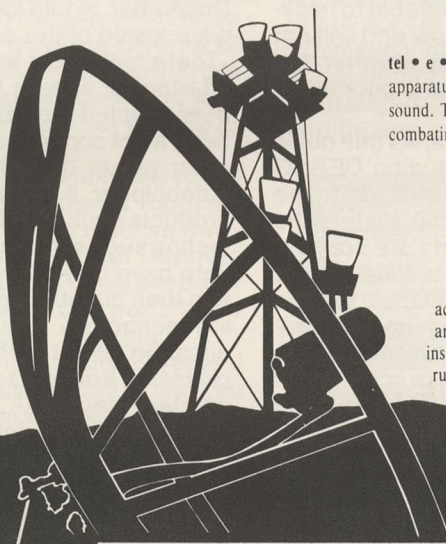


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3341 Holwyn Drive
Lexington, Kentucky 40503

communications network between Baltimore headquarters and 17 regional training centers over USA. They envision two hours per day, using Ku band satellite, five days a week with service operational by end of year.

JAPANESE KDD network will begin operating 24 hour per day service sent across USA on Galaxy satellite (probably 3) to Intelsat uplink at Fillmore, California where it will go on to Japan on Pacific Intelsat. Service scheduled to be operational by October 1st.

ITN, International Television Network, now has 16 broadcast affiliates taking feeds from Westar 4 between 12:30 AM and 8:30 AM daily. Service collects TV programs from overseas,

recycles them to broadcast stations via Salt Lake City uplink and TV broadcasters tape programs for use during specific day parts.

OAK is fighting to have its patent infringement suit brought against M/A-Com, over alleged misuse of Oak patents in Videocipher, stay in Virginia court. M/A-Com wants court changed to Southern California which it finds more convenient; Oak says it filed suit in Virginia court because that court has reputation for speedy resolution of such issues.

HOSPITAL Satellite Network, Spacenet 1 scrambled by Orion, plans November 1st start up of "Patient America" programming service to run between 4 PM and midnight eastern.

COOP/ continued from page 5

chip he is demonstrating or offering is not what it is represented to be. And it will work only as long as the owner of the 'mother unit' continues to pay for the services, or, until somebody at M/A-Com stumbles across one of these clone-chips and reads out an 'address' left carelessly behind in the chip's memory.

I am intrigued by 'U30 solutions' to Videocipher but to date nobody has been able to convince me that solving for U30 is in fact a permanent solution at all. DESUG, quite independent of my own analysis, seems to agree.

Perhaps the only way we are going to find out whether the U30 solution is or is not a permanent solution is to watch what happens as more and more U30 modified chips hit the street. Sooner or later these modified chips will end up in a LinkAbit-M/A-Com lab someplace and then the software people who designed the system will have the opportunity to tear apart the U30 modified chip to see if they can 'patch around the patch' with a software change at the master uplink computer. It is a gigantic game of cat and mouse.

That Videocipher is at least partially vulnerable to hackers is now apparent. What we do not know and will not know for perhaps another 3 to 6 months is whether that vulnerability is a minor hiccup or fatal. Some people are betting big bucks that it is fatal.

After the U30 **modification** crowd, the ranks thin out in a hurry. Three, perhaps four groups including DESUG are attempting to unravel **all** of the mysteries within the VC2000. That of course means taking the system the next step beyond U30. Most of the efforts are concentrating on **U7** but still other chips inside of Videocipher are also getting close attention. Schematics were a problem for awhile; an outfit in Wyoming reverse-engineered the circuits and began offering schematics of the VC2000 in June. Unfortunately, these schematics were only as good as far as they went and they did not go inside of the chips in question. Then some 'traitor' at M/A-Com brought out a complete set of schematics that included ramp and digital line test points and voltages, and clearly displayed the information flow between chips and circuits. Needless to say that helped a bunch and in short these drawings were in the Far East where some very clever reverse engineering people tackled the project.

It was in late July that a group working on Videocipher reported to me that they had seen a prototype Videocipher clone in operation in Panama. That's the 'country' of Panama. Mind you this was not reputed to be a 'chip'

that has been cloned or modified but rather a brand new from scratch Videocipher-like descrambler. They said it descrambled **everything**, including Oak Orion and the not for home use Request TV service. I filed the report away relatively certain the box, claimed to come from Taiwan, did not really exist. Six weeks later I would run into another similar box, this time in the southwest. It was also represented to be a 'prototype' and it claimed the ability to decode everything in the sky, Oak or Videocipher, but it had an IBM 'PC' plugged into it via an electronic umbilical cord. Even if you accepted that it was working, as the demonstrator claimed, it was hard to justify purchasing an IBM 'PC' to go with it! This box too, they said, came from a Taiwanese firm. There were even some poorly done brochures, written in French and English, which purported to offer the system for sale through some **European** agents. The fellow demonstrating the unit represented that he was an 'agent' for the Taiwanese principals and was authorized to test the waters for importing semi-completed units into North America. I smiled and asked "**Can you also provide a lower cost Taiwanese copy of the IBM PC as a part of this package?**" I was assured that was 'no problem' and then it was further explained that a newer version, ready in December, would include the necessary computer software inside of the descramble-everything product.

There followed a lengthy discussion of the illegality of offering for sale, in US commerce, **any product** which descrambled the DES based Videocipher system. It has been a pet concern of mine that even if DESUG or some other group does negotiate 'the perfect solution' to Videocipher, it will be virtually impossible to distribute products such as this given the intensity of the law protecting such scrambling systems. Most of the hackers to date have been mindful of the illegal nature of busting and then distributing data or products that use the busting technology. I found the Taiwanese people virtually uncaring about this 'small' (as they characterized it) problem. **I know** it is no 'small' problem. I am in fact disappointed that M/A-Com and GI have been so totally negligent in pursuing those who have been dispatching U30 chips hither and you via Federal Express. While it is possible that a business of a sort might be built around producing cloned chips or cloned Videociphers **off-shore** and then purposefully limiting their distribution to offshore (such as the Caribbean, Central and South America), the folks from Taiwan were ready to rent quarters in southern California and simply start building units there! **They did know** they could not ship **complete units into the country** because they had experience with shipping Apple Computer look-alikes in as pre-assembled units. The US Customs folks put that opera-

tion out of business.

At the moment, I think M/A-Com and GI can rest a little easier. Some people **have** broken their technology, but a much bigger problem now presents itself to these hackers than the original busting exercise. What do they do with their 'technical expertise'? Or, in the case of the IBM PC attached unit, the solution may be apparent but for now the execution of the solution costs far more than the system they have beat, even at the outrageous prices asked by the software programmers.

DESUG, unlike others, is not yelling 'Eureka' just yet because they will not accept a solution that simply outguesses **parts** of the Videocipher puzzle. Breaking Videocipher was the easy part; understanding **why it broke** and then being able to put it back together again so M/A-Com's control computer cannot override the hacking is still a significant mountain to be climbed.

NETWORK Scrambling And Emotions

As we wrapped up a review of the 'after-math of hearings' and scrambling in our May 15th issue, I realized that no update had been provided on the status of 'network' (read CBS) scrambling. I pondered dashing off a quick few paragraphs in the interest of completeness and then decided that since nothing substantive had really happened, we didn't need to rehash anymore 'bad news' in May.

A couple of days later I was meeting with some engineers who design equipment in the TVRO field and one of them asked me if I had seen 'the new' type of scrambling on Telstar. I pondered what he might be talking about and then he hopped up to a dish controller and showed me.

"Oh, that's CBS and their Videocipher I format scrambling" I said as soon as it came up. He responded that it didn't look like any Videocipher he had ever seen. So to the blackboard I went (blackboards are a favorite of mine, especially when I have several different chalk colors available so I can draw over the drawings with changes; it's the kid in me!) and I drew out how M/A-Com created the Videocipher I system.

"That bears virtually no technical resemblance to the HBO video scrambling technique" he offered. Right on. And it then occurred to me that the last time we (anybody) really saw and studied the Videocipher I system was way back in the fall of 1983. Maybe there are other new-to-TVRO people out there who also don't know about Videocipher I and how it works. I'll explain.

HBO wanted a secure scrambling system. Several firms offered to build one and a few even demonstrated their creations. M/A-Com demonstrated something they called Videocipher, first in the late spring of 1983. It was a frightening system because the audio was turned into a digital transmission stream and encrypted while the video was chopped up line by line with a technique called line-segmentation. That means you take each of the nominal 350 or so 'real lines' in a TV picture (lines go from left to right and they stack one atop the other) and you cut it up into short strips. Imagine a screen 15 inches left to right. A non-segmented line is intact, continuous, from edge to edge of the screen. A segmented line has been chopped up into a string of short lines; perhaps one is 1 inch long, the next

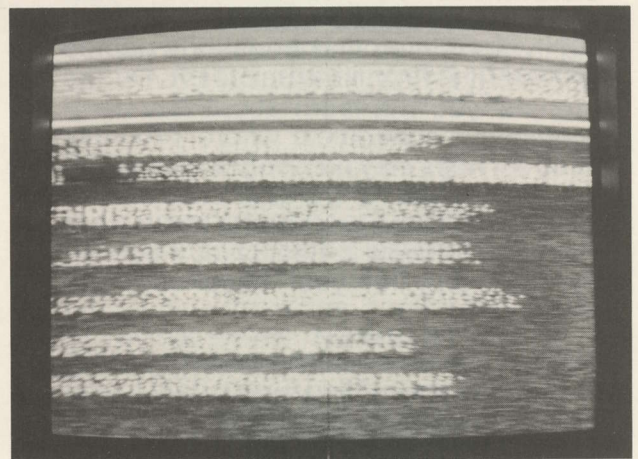
is 3 inches long, the next 2 inches long and so on. Now once you have chopped the individual lines up into shorter pieces, you change the sequence within the lines; moving the first chunk to the middle, the next chunk to the opposite end and so on. You can visualize what the new 'picture' would look like; line segments appear in helter-skelter fashion and while the total content is still there, the segments that follow and precede one another on the screen are out of sequence. Ipso-facto... a scrambled picture.

Shuffling the picture around was like shuffling a deck of cards. You could shuffle it once and have a moderately unintelligible pictures, shuffle it twice and have 2^4 unintelligible pictures, shuffle it again and have 2^8 unintelligible pictures and so on. You could shuffle it so many times that there was seemingly no picture. Alas, you had to be able to put it back together again at the other end!

When M/A-Com demonstrated the system to HBO, the HBO people flipped. Here at last was a system that would be virtually impenetrable. They signed on the dotted line. Alas, you had to be able to put it back together again and as M/A-Com moved from the laboratory curiosity with their system to pre-production, they discovered that putting it back together was far more difficult than chopping it up.

I won't bore you with the details, nor embarrass M/A-Com further with a recounting of what happened; suffice to say they came back to HBO with a plea that HBO let them off the hook and accept a substitute system which some inspired person at M/A-Com had named Videocipher 'II'. The audio for the second generation system was still 'gone', using digital encryption techniques. The video was, well, bruised but hardly destroyed. The decision boiled down to costs. M/A-Com could produce the original ('I') system still, but not for the price they had been quoting to HBO. HBO wisely elected to accept the second generation system.

To make Videocipher 'I' work, you need a bunch of solid state memory. All of those line segments have to be rearranged in the proper sequence. If you chop and shuffle and rearrange the line segments at the trans-



CBS 'line segmented' video is Videocipher 'I' encrypted using technique originally developed for HBO problem. Decoders proved too costly, however, so M/A-Com adopted a less complicated video system.

mitter so that they are transmitted in a heavily shuffled new sequence (say with chunk 1 as chunk 16, chunk 2 as chunk 48, chunk 3 as chunk 1 and so on), there has to be a 'memory' circuit inside of Videocipher to receive and store all of the chunks as they come in. Let's say you design the system so that you can shuffle any chunk in any 8 line portion of the screen to be anyplace within that 8 lines as it is transmitted. And let's say you have decided that within an 8 line segment, you can have 16 sub-segments per line. That means that within 8 lines you will have 8 times 16 or 128 different 'line holes' to fill. Any of the original 128 segments could then be transmitted at any location within the 128 'holes' to be filled. The task of the decoder is to not only receive the 128 line segments for those 8 lines, but to

store them, await instructions on how they are to be rearranged for display, and then rearrange them in perfect and proper sequence before they are released from the memory. In our example, this happens with 8 lines at a time, and then as the 8 lines are being released to the screen for display we have the next group of 8 lines filling up the memory. In actual practice, you need to store one set of 8 lines and then simultaneously store the next set of 8 while you are rearranging and releasing (dumping) the first set of 8. All of this has to happen at nearly the speed of light (that's fast) and it has to occur in line group by line group sequence over and over again, flawlessly. More over, the instructions are encoded (ciphered) so a clever person cannot simply pirate the same thing with his own decoder box.

This is in theory about the same thing that happens with the digital audio 'data stream' in the Videocipher system. The process gets more complicated with the video however because it takes far more solid state 'memory' to store the video lines than it does the digital audio pulses. If the video were not still analog, if it were digital video, then the storing problem would be less complicated. However, by turning the video into digital pulses at the uplink and transmitting it as digital data, each downlink would have to process the video as digital data and then reconvert it back to analog data before the video could be used by the cable, broadcasting or home system. Digital to Analog (D to A) and Analog to Digital (A to D) conversion systems are still frightfully expensive, and frightfully complicated. So M/A-Com stopped short of the ultimate-ultimate video scrambling system of the future by leaving the video in analog form.

With HBO opting for a 'soft video encryption' and a hard audio encryption system, that left M/A-Com with a far more complicated system which nobody was going to use. Enter CBS. The CBS people were only shopping for a few hundred decoders when they decided to encrypt. A pair or so for each network affiliate would do everything they wanted done. HBO, on the other hand needed more than 10,000 decoders. The CBS project lent itself to a higher grade and higher priced 'spread' simply because the number of units involved was small. A \$10,000 decoder for a CBS affiliate was not a big deal. For a cable affiliate of HBO with 700 cable subscribers, it was out of the question. For ultimate use in homes, a \$10,000 or even \$1,000 box was irrational.

Videocipher 'I' was the answer CBS selected. An example of a CBS transmission utilizing this system is shown here. I have selected a transmission with plenty of on-screen graphics because the line segments being moved around 'at random' really show up well when you are trying to read text on the screen. You can't read text on the screen as you can see.

I would estimate the picture you see here is only about 10 to 15% as 'scrambled' as Videocipher 'I' is capable of scrambling. Remember, you can shuffle the line chunks as often as you want; or, as often as you can still shuffle and figure out where they go back at the receiving end of the system to restore the original image. This particular transmission is not nearly as 'segmented' as many I have seen; the first demonstrations put together by M/A-Com back in 1983 were so totally chopped up that there would not have even been a 'hint' of text on the screen here. I guess as M/A-Com got out of the Lab

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and into the field with their system, and CBS put it to work on Telstar for the Mountain Time Zone feed, they discovered that you could overdo the shuffling of the shuffle of the shuffle, and backed it down to a more realistic level. No matter, without the encryption 'key' nobody is going to put the pieces back together again anyhow. This is the ultimate Humpty Dumpty challenge.

While the technology has been ripping along in the hands of CBS, and M/A-Com has been anxiously trying to talk other networks into the same system, not everyone has been happy with the 'progress'. CBS is on 'new ground' here with their scrambling decision and an interesting turn of events has transpired. CBS, as you might suspect, maintains that their network to affiliate feeds are 'private property'. They also maintain they have a legal right to protect the copyright of their private property. Indeed, the 1984 Cable/Satellite act signed by President Reagan, from which our authority to watch certain satellite signals flows, tells firms such as CBS that 'If you wish to protect your property, then you must scramble those signals'. CBS did just that.

Alas, there was a significant negative reaction from the home TVRO users over CBS scrambling. The same reaction was assured if and when any of the three networks scrambled. It was one thing to scramble say HBO, or even WOR. It was quite something else by an order of magnitude to take away the CBS (NBC, ABC) service. CBS, I suspect, did not expect the precise reaction they received. Basically, SPACE and individuals blew up and in their rantings and ravings made all sorts of arguments as to why CBS should not or hopefully cannot do such a dastardly thing. Some excerpts from Rick Brown's (SPACE) testimony before the House Subcommittee March 6th hearings illustrates:

"CBS, a network which has been at the forefront in defending, against all challenges, its right to speak to the American public is now denying the rights of millions of Americans to view and listen."

"The development of the home satellite earth station technology has finally caused CBS to recognize that as a broadcast network, it has an obligation to provide its programming to all Americans."

"CBS . . . has benefitted from the use of the public spectrum; CBS . . . has lowered its operating costs (with satellites); CBS has occupied a portion of the nation's limited (radio) spectrum (thus) denying the use (of the same) spectrum to others."

And the final thrust:

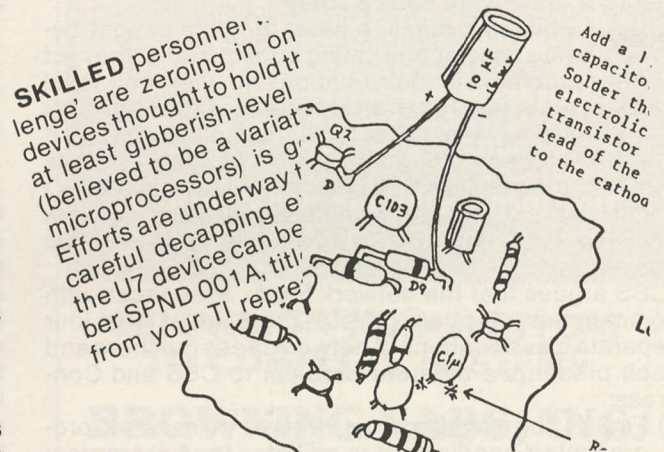
"By scrambling its' feeds to affiliates, while refusing to provide access, CBS is terminating service to millions of Americans without any rational or logical justification."

Basically, what SPACE is saying to Congress is that CBS (and the other major networks) have some sort of moral and perhaps even legal mandate to 'serve all of America' and 'all Americans' with their programming. SPACE is suggesting that because CBS receives numerous 'subsidies' and 'special rights' in the course of their business activities, from the American public, they in turn have an obligation to 'return something to (all of) the American public'. CBS, a privately owned (albeit public) corporation might be expected to be cagey in its response.

HBO and others now scrambling have defended a-

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against that charge by simply denying they are any different than a distributor of tires; they can sell to whom, and where they wish and their is no 'public interest' requiring them to sell to others, or elsewhere. CBS could be expected to be more cautious with their response since indeed they do receive numerous 'perks' in their business life and much special treatment because of their 'national stature' and position. To take the same 'private-is as private-does' stance as HBO would be to attract a perhaps uncomfortable study of the 'public benefits' they currently receive as a national network. They would like to avoid such a 'study' because ultimately they might lose some of their present 'rights' if there were such a study.

CBS is walking a thin line here; they are caught between 'being special' and 'being public'. And at the root of their problems is their relationship with their local network affiliates. The network affiliates relate to CBS in the same way that cable (affiliates) relate to HBO. If TVRO has been cutting into the profitability of cable systems, it is possible that down the road ways TVRO might also cut into the profitability of local network affiliates. CBS naturally has to protect against that happening.

CBS argues that the network feeds, even those with commercials intact, are private. There are at least four separate classifications of network feeds out there and each presents a different problem to CBS and Congress:

- 1) First is the simultaneous release of network programming; sending out to affiliates the full program and commercials just as the affiliate will air them, at a time selected so that the affiliate will air the programs simultaneous to receiving them.

This is the feed category which most TVRO users watch most often. And this is the most difficult category for CBS (et al) to deny to the TVRO public since in real time the very same programming with the very same commercials is, indeed, being shipped out by terrestrial VHF and UHF affiliates. The 'transmission' via satellite may well be private but with no perceptible time delay it is being simultaneously retransmitted by nearly 200 affiliates. And as that happens, the material which CBS says belongs to them suddenly belongs to everyone. It becomes 'public domain' material.

- 2) Second is the pre-feed material; programming, sometimes without commercials, released ahead of

the actual airtime and transmitted for taping and later use on the air.

CBS would maintain that their commercial rights to 'Crazy Like A Fox' are compromised if episodes are viewed ahead of their scheduled network release time by those peeking in on pre-release feeds. Some television programs such as *Dynasty* and *Dallas*, do indeed have 'serial value' and the pre-release of serial episodes to some segment of the public could well have a measureable impact on the commercial value of the program. CBS may well be correct on this one; they perhaps should scramble all of their pre-feeds which concern them.

- 3) Third is the inward bound sports and news material.

This is the raw programming material used by the network to compile their timely coverage of human events and as we all know, there is a near-constant inflow of material from the field of which only a small percentage ever makes it to the network intact and gets 'on air' in a terrestrial transmission mode.

Much of the taped material sent to the network headquarters via satellite is unprocessed; that is, electronic correction of timing and phase has not taken place. One of the rules is that you don't correct for bad camera sync (etc.) in the field; you leave that for the guys to do in New York or Los Angeles where they can correct it once and do the correction properly. That means that the raw tape is raw in more ways than simply editorial; it is also often raw from a technical standpoint. And that presents a unique problem to scrambling. The scrambling system wants to see an almost perfect (in sync, in phase) video picture if the descrambler is going to properly decode at the receiving end. So if you scramble all incoming news (and sports) feeds, you could have a new problem caused by the imperfect condition of the 'raw video'.

Setting that possibility aside, if CBS (et al) were to scramble each of their inward news feeds, there would need to be a scrambler at each of the possible news-feed origination points. There are far more such spots than you might suspect; hundreds in fact. This is not a small nor inexpensive problem. Perhaps these feeds should be scrambled; but getting there from where we are is a long and uncertain course.

- 4) Fourth, we have the direct communications between the network and its affiliates. This includes special promotional materials, program scheduling changes, pep talks and other communications which are basically 'electronic inter-office memos'.

Since most of these feeds originate in either New York or Los Angeles, are fully under the network's control and use the same uplinks and transponders as the regular public feeds to affiliates, scrambling these feeds would present no unique problems. And indeed, CBS (and others) should be scrambling or otherwise protecting their internal memos.

As we discussed in **CSD** for March and April, CBS has suggested that there may be 400,000 US homes not served by one or more of their local affiliates. *SPACE* and others maintain the number is far larger than that; perhaps by a factor of 10. That CBS admits to a number as large as 400,000 (2% of the American homes) is of some interest. CBS has assigned serving these 400,000 homes to a 'taskforce' of its affiliates. In effect, CBS would like the affiliates to solve the problem since it is

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the affiliates which CBS is trying to protect here.

The only potential solution mentioned by the task force is translators, low power TV rebroadcast devices as we discussed in our April issue. There have been translators around for twenty five years now and they do a wonderful job for rural America. But after 25 years, there are still at least 400,000 homes without CBS service. Perhaps something newer and better than translators should be given a shot at solving the problem.

And in truth, the problem is already solved! Backyard dishes have solved the problem and there is no more problem.

Except, of course, the fact that CBS and its affiliates do not 'approve' of the solution. So we have an impasse and the roots of our present problem with CBS. When a concluding chapter to this topic is finally related it will be clear that the only viable way to serve the balance of America now denied CBS (et al) programming is via satellite. Some people and firms will simply take longer to recognize the inevitable than others.

M/A-Com + GI = 's ???

Of all of the interesting and provoking 'equations' one could create in the satellite television world, few had played with the formula M/A-Com + GI = s before first word began leaking out of their respective corporate headquarters. How, indeed, would the new 'defactor scrambling standard animal' equate with General Instrument at the helm?

M/A-Com reportedly sold its Cable and Home 'group' of products and companies to General Instrument for a whopping \$220M. Those are the kind of numbers usually reserved for major city budgets or new Navy fighter planes. They don't happen all that often in the normal course of American business. Why would anybody pay M/A-Com nearly a quarter billion dollars for a floundering, perhaps defective group of products and companies? Obviously GI knew or thought they knew something many of the rest of us did not know.

According to press reports, GI coughed up \$150M (ie. \$150,000,000) in 'cash' and is somehow floating the balance of \$70M with some sort of tricky corporate financing. As best we can tell, M/A-Com is out 'clean' and is not carrying any notes.

What M/A-Com gets out of this is obvious; a mountain of cash. There may be more to it than that; we'll see. What GI gets out of this is less clear. They go from 'cash rich' (yes, that happens briefly in business on occasions) to cash-poor but they get plenty of new assets to help them carry on anyhow. First they have purchased the **Comm-Scope** cable division. These people make coaxial and other cables in the country. Heading up Comm-Scope has been a man named **Frank Drendel** who is one of the brightest executives in electronics. Drendel, according to reports, will continue to head up Comm-Scope as well as the balance of the M/A-Com properties GI acquired in the deal. GI also gets the **Prodelin** antenna company. Prodelin was building parabolic dishes before most of us could spell parabolic and they played an important, instrumental part in getting the cable and later home dish industries off and running. GI also gets the Puerto Rico plant where M/A-Com has been assembling things like Videocipher units

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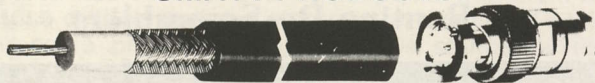
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(plus feeds for the Omni-Spectra company and other M/A-Com products). GI ends up with the ownership of the M/A-Com T1 and H1 (etc.) series of home receiver products as well.

Much is made in publications such as the **Wall Street Journal** concerning the 'potential lucrative business' which GI is buying with the M/A-Com Videocipher line. Down in the fine print, it appears M/A-Com is keeping their commercial (cable) VC2 product as well as the more complex VC-1 (CBS encryption) system and equipment. LinkAbit, the division out in La Jolla (Ca) that designs all of this computer-encryption stuff stays with M/A-Com as well.

WSJ wrote "For M/A-Com, the sale is part of a restructuring aimed at withdrawing from consumer oriented businesses it has built up in recent years". Analysts figure M/A-Com is disposing of divisions and wholly owned firms which comprise 24% of the firm's annual sales for the year ending September 28, 1985; and 13% of its operating earnings for the same period. M/A-Com says it will 'possibly shed some other businesses' and refocus on microwave parts and commercial communications products.

WSJ quotes a financial analyst as summing up the deal in this manner:

"M/A-Com becomes financially stronger, but loses a stable earnings base; General Instrument receives a stable revenue stream in a non-growth area". So what is this; is this guy saying Videocipher is a 'non growth area'???

What Harry Rosenthal of Prudential-Bache Securities does say is **"If the descrambling business is so great, why did M/A-Com give it up so cheap?"**. At least one additional analyst tapped by WSJ for comment offered "There will be a big bulge in sales of descramblers in 1987 and 1988; but then sales will fall off, fast". Most of these financial wizards seem to feel that the only real descrambler market consists of those people who **already own** a home dish, and that with scrambling and the price of descramblers and programming, not too many additional people will be buying dishes.

That should make your day.

M/A-Com lost \$54.7M on sales of \$212.2M in the quarter ending March 29 of this year. That's no easy trick. Some in this industry would like to chortle and believe M/A-Com lost money in the last reported quarter because of the Videocipher disaster. Nope; their financial people swear up and down Videocipher made M/A-Com money in that quarter. If they tossed away \$54.7M, they did it someplace else.

Just how many VC2000's do you think GI might have to sell to get their \$220M back? If they wasted lots of money and only netted \$100 for each VC2000 shipped, they will need to sell \$2,200,000 VC2000s to get their money back. Anything they make on Comm-Scope or Prodelin or other products acquired would be additional profits. On the other hand, if GI could pocket \$200 for each VC2000 they sell, they only need to sell 1.1M to get back their \$220,000,000. That's a possible number if anyone can figure out how to get TVRO going again, if nobody busts Videocipher, if Congress doesn't call a halt to scrambling and on and on and on. If . . .

Suppose somebody does 'bust' Videocipher. What sort of protection do you suppose GI has built into their

contract with M/A-Com to protect GI should this happen? Has M/A-Com guaranteed to GI that 'Videocipher will **never** be busted'? But, if it is busted... then what? Does M/A-Com have to give a hundred mil or so back to GI? Maybe the deal is like buying a tree at a nursery; it was alive when you loaded it into your car, it was alive when you put it into the hole in your yard. The next day it died. So who's fault was it that it died?

Neither Patti nor I own stock in GI. But if I did, I think I would want to attend the next general stock holder meeting to ask some questions. Like **"What happens to 'our' \$220,000,000 investment in these M/A-Com companies IF somebody does bust Videocipher?"** I wouldn't be satisfied to hear how wonderfully secure it is, how nobody will ever bust it. I'd want to know how I, as a stockholder, am protected from a GI management error just in case it does get busted. I hope somebody owning GI stock does raise that question because it needs to be raised.

Other writers reporting on the sale ponder some blue sky for us. GI makes set top cable converters. They are a major supplier of set top converters (allowing cable patrons to tune in channels on mid, super and hyper bands; beyond the range of most TV set's tuning). Several writers have created a new product, on paper for GI; they see engineers taking the Videocipher system from M/A-Com and the set top converters from GI and building a new 'addressable, decrypting set top converter'. The idea is that cable operators would disconnect the rack mounting VC-2 descrambler and let the HBO (etc.) signal onto the cable in its Videocipher scrambled format. Then the individual set top converters, when and as authorized, would descramble HBO (et al). Analysts believe this would solve the cable piracy problem, which cable people feel takes nearly \$1B in revenues from cable each year. GI didn't have to buy M/A-Com to do that; the technology already exists to make that happen if anybody could figure out how to make it secure.

However, if GI has this in mind, they have a much bigger business plan than simply selling a million or so VC2000 units to home dish owners. There are more than 40,000,000 set top converters out there and everyone of them would have to be replaced.

All of this comes back to 'busting Videocipher' sooner or later. If the TVRO people 'bust Videocipher', whether it is Desug, or somebody else, there is the temptation to tool up for 40,000,000 cable set top converters. If you think the marketplace for building 'Blackciphers' for a million or so home dishes is tempting, toy with building a **'Blackcipher set top converter'** for 40,000,000 homes. Mind boggling. If somebody tries to take Videocipher technology directly into the home, whether it be GI or someone else, the very best minds in the world will be turned loose on busting Videocipher.

Well, I wish GI well. I hope that it makes some big changes in the way Videocipher is priced, distributed and promoted. I hope they follow through with the M/A-Com game plan to bring us chip sets that can be built into receivers rather than those horrendous, poorly conceived 'IRD bricks' developed for the purpose of adding descrambler capabilities to existing receivers. The ball is now squarely in GI's court; now we'll see what kind of ballplayer they are.

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MAKING OF A Cover

"Are you ready to meet Marina?" asked Peter Sutro while Patti and I were visiting in New Jersey this past July. I thought that a foolish question; Marina (Sutro) was standing right next to me. We had met some years prior. 'Marina whom?' I responded. The answer was Marina Albee, the young lady whom Orbita Technologies' resident Guru Kenny Schaffer was chasing all over the world, literally. **"Marina has just returned from four weeks in Moscow"** explained Peter. **"Kenny met her while he was installing the Columbia University Molniya tracking dish."** Marina, it would turn out, was a grad student at Columbia specializing in some obscure area of Russian culture which only she and perhaps six other people in the United States understood. Kenny had spotted her across the room watching his Molniya television 'play' at a Columbia screening and dispatched a bizarre note to the young lady. Kenny writes notes that are far more bizarre than the average extrovert. Even Marina found the note obscure. Undaunted, Schaffer penned off a second note and sent it traveling across the room. Marina still resisted the persistent Schaffer. How she finally let her guard down sufficiently to allow Schaffer to talk with her is the subject of a forthcoming book; probably in Russian.

"Let's do a special Halloween cover for Coop's" suggested Schaffer to Coop. He muttered something about having rock star **Alice Cooper** appear nude in an upended fiberglass dish in the middle of Times Square. "Can we paint a sign on the dish, in Russian, pleading for world peace?" Coop wondered. The concept was not as bizarre as you might imagine. In his previous life Schaffer had literally created 'Alice Cooper', complete with snake. Schaffer returned to Marina's side and held her hand in deep contemplation. Several minutes later he returned looking inspired.

"How about turning a dish into a broomstick and having Sting ride it through the sky with the World Trade Center towers looming in the background?" suggested Schaffer. The average editor would have walked off to find more intelligent conversation at this point. Not Coop; he was well aware that Schaffer was a close friend of the one and only **Sting** and that Sting owed a recent hit song to some lyrical suggestions that popped out of Schaffer's Grand Prix mind. **"Can we cue the moon so it is full for the shot?"** Coop queried back. Schaffer disappeared to search the Sutro bookshelves for a tide and moon table. Minutes later he returned. **"The moon won't 'cue'"** said he with a sincere amount of disappointment; **"It will practically be non-existent on Halloween this year"**. Back to the drawing boards.

In the middle of a meal, more than an hour later, Schaffer stopped in the middle of a sentence which was explaining how Marina's father liked to invite his friends over to watch Kenny eat lobster. For those who have never supped with Schaffer when he orders lobster, it is truly worth the cost of buying him a dinner just to watch how the lobster disappears shell and all right before your eyes. He segued from 'lobster' to **"Ghostbusters - that's it, we'll dress up Marina and put her**



'CUE THE EXTRAS; can someone get the pigeon off the kid's head?' Perhaps AVCOM will commission Schaffer to create a series of posters for their marketing program.

in midtown Manhattan just like the famous Bill Murray pose. On her back we'll strap a spectrum analyzer - can you get us an AVCOM unit as a prop? - and what is more Halloween than Ghost - I mean TI Busting???"

The 'original' Marina (Mrs. Sutro) lowered her chin and peered over the top of her bifocals. "Kenny, I have put up with you calling Peter at 1 or 2 or 3 AM in the morning. I have allowed you to stay here for days on end playing with our computer. I have even allowed you to take my Peter on a trip in a small, and I'm certain dangerous, one-engine airplane with you at the controls. But I cannot allow you to pose this child in midtown Manhattan dressed up like Bill Murray!"

On our front cover this month Marina Albee poses in midtown Manhattan with an AVCOM PSA-35 spectrum analyzer strapped to her back. Only Schaffer could have pulled this off without getting himself, Marina and photographer Beth Schiffer thrown into the New York City pokey. But then only Schaffer could have created Alice Cooper, invented the original wireless microphone for entertainers or awoken in the middle of the night with a set of lyrics running through his head that rock star Sting would later turn into a world million seller. Thank you Kenny for being Kenny. You can eat lobster at our house anytime, as long as you bring Marina with you.

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